City of

Laguna Woods Climate Adaptation Plan

December 2014

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ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

"Climate change is already affecting California and is projected to continue to do so well into the foreseeable future. Unavoidable climate impacts can result in a variety of secondary consequences, including detrimental impacts on human health and safety, economic continuity, ecosystem integrity, and provision of basic services. Communities that begin planning now will have the best options for adapting to climate change."

–California Adaptation Planning Guide (Cal OES and CNRA 2012)

This Climate Adaptation Plan ("Plan") is intended to establish an approach for the City of Laguna Woods ("City") to prepare for a future with evolving and potentially varying climate conditions. The development of this Plan was made by possible by a Community Development Block Grant (CDBG) Component Award for the 2008 Disaster Recovery Initiative and was undertaken in a manner aligned with the California Adaptation Planning Guide.

This Plan is organized as follows:

- **Chapter 1: Context** – Provides introductory and background information
- **Chapter 2: Exposures** – Describes how the climate could change in Laguna Woods
- **Chapter 3: Vulnerabilities** – Provides information regarding the susceptibility of structures, functions, and populations to climate change exposures and impacts
- **Chapter 4: Adaptation Strategies** – Describes the goals, policy objectives, and implementation actions that the City will pursue to further its climate adaptation efforts
- **Chapter 5: Work Plan** – Provides information to support implementation and reporting efforts
- **Glossary** – Explains the meaning of key terms used in this Plan
- **Bibliography** – Notates the source material used to develop this Plan

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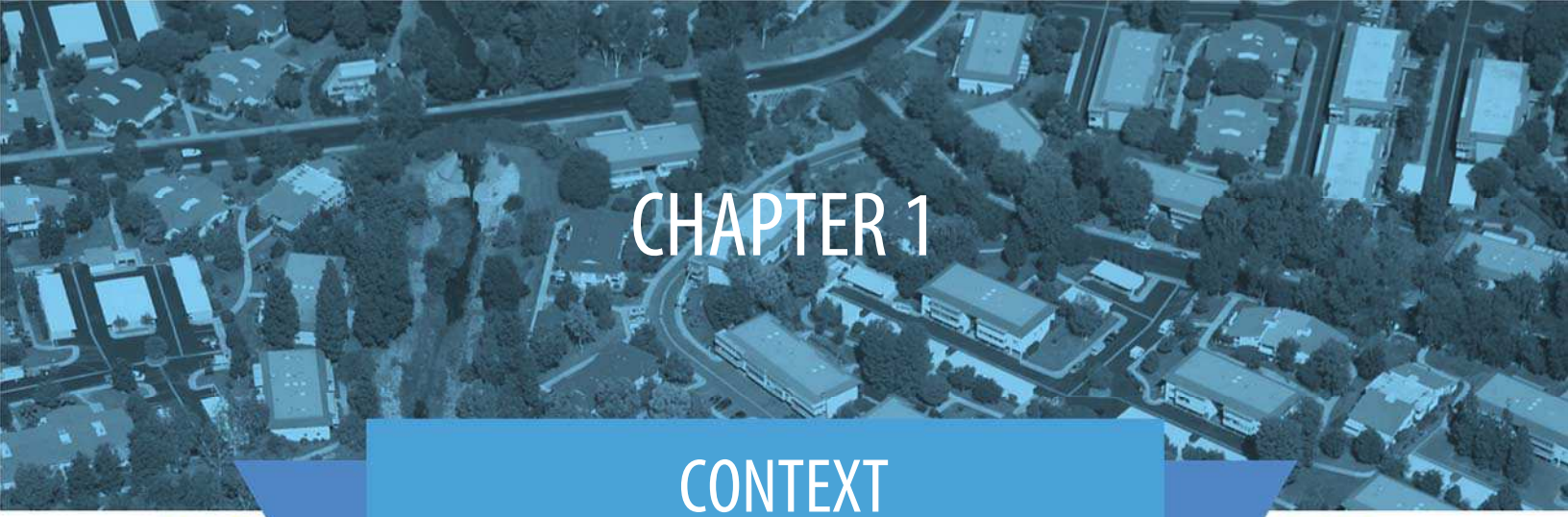


CHAPTER 1

CONTEXT

Climate change is a global phenomenon experienced at the local level. Although Laguna Woods' Mediterranean climate is less subject to extreme weather fluctuations than climates in other parts of California, its unique demographic characteristics (including a population comprised predominantly of older adults on lower than average incomes) make it highly vulnerable to climate change impacts.

This chapter provides introductory and background information for this Climate Adaptation Plan ("Plan").

Purpose and Scope

This Plan is intended to establish an approach for the City of Laguna Woods ("City") to prepare for a future with evolving and potentially varying climate conditions. In light of the City's well-established role with respect to public safety, a particular emphasis was placed on consideration of climate change impacts with the potential to affect wildfire risk, individual well-being, public health, and water supply. Environmental interests, including ecosystem function, and matters of economic continuity, were also considered during the development of this Plan.

This Plan is not intended to reduce greenhouse gas emissions or assign fault with respect to greenhouse gas generation. Rather, the purpose of this Plan is to help the City thrive in likely future climate conditions, which are projected using scholarly research and information provided by the State of California. Climate adaptation is a strategic planning process that considers how the climate could be different in the future and identifies what the City should do in order to respond to potential climate change impacts. "No-regret" strategies are identified that will produce public value regardless of how (or if) the climate continues to change.

This Plan is authored by the City and, as such, is limited in scope to areas within the City's jurisdictional control, including its policy and planning framework (e.g., General Plan, Local Hazard Mitigation Plan), regulations (e.g., development and zoning codes), and physical properties (e.g., City Hall, parks, medians, public rights-of-way, and public roadways—portions of El Toro Road, Moulton Parkway, Ridge Route Drive, and Santa Maria Avenue). It is important to note that the City is one small part of a much larger, interconnected, multi-disciplinary, and multi-jurisdictional effort required to successfully adapt to climate change.

Issue Statement

Climate change, for the purpose of this Plan, is defined as the phenomenon of shifts in the global climate as a result of increased concentrations of greenhouse gases in the atmosphere. The most common greenhouse gas is carbon dioxide (CO_2), but others include methane (CH_4), nitrous oxide (N_2O), and various artificial compounds such as chlorofluorocarbons (CFCs) and hydrofluorocarbons (HFCs). Greenhouse gases reflect heat back toward the earth's surface rather than allowing it to escape into space, in much the same way as the glass walls and ceiling of a greenhouse help to trap heat inside. As the concentrations of greenhouse gases in the atmosphere increase, more heat is trapped, triggering changes in the global climate system (IPCC 2013).

In the last 10 years, California has experienced extreme heat, wildfires, and precipitation in patterns that would not have been expected given the previous 100 years of weather (Cal OES and CNRA 2012; Western Regional Climate Center 2013a; Western Regional Climate Center 2013b). Although weather events may be caused by a number of factors, the last decade or more of weather is consistent with the following patterns that are expected as a result of climate change:

- The 10 warmest years on record have all occurred between 1998 and 2014, with the warmest decade on record being 2000 through 2009 (NASA 2014).
- California is currently suffering from one of the worst droughts in its recorded history. As of early November 2014, the entire state was considered to be at least "abnormally dry" and over 94% of California was in a state of "severe," "extreme," or "exceptional" drought. The most severe drought conditions covered more than half of California, including Laguna Woods (National Drought Mitigation Center 2014).
- The number of heat waves and severity of intense storms have increased substantially in the United States, recently, as compared to the past 50 to 100 years (Environment America Research and Policy Center 2013).

Climate change is a global phenomenon experienced at the local level. There is consensus among the world's climate scientists that even if concentrations of greenhouse gases—whatever the cause—stopped increasing today, the effects of climate change will still be felt for the foreseeable future. If greenhouse gas concentrations continue to rise, the risks posed by the exposures are expected to increase as well (IPCC 2013).

Local Setting

History

Laguna Woods, California, occupies approximately three square miles of land that was once a part of south Orange County's expansive Moulton Ranch. Prior to the 1960s, dry farming and cattle grazing dominated the area, with a few scattered ranch dwellings and barns.

In 1962, Ross Cortese, a young developer whose previous projects included Rossmoor and Leisure World Seal Beach, purchased a portion of the Moulton Ranch. His goal was to create a second Leisure World community or, as he said, "to supply the basic needs of life for people aged 52 and older; create a serene atmosphere of beauty; and provide security, recreation, and religious facilities—then leave the living to the individual." His dream materialized and on September 10, 1964, Leisure World Laguna Hills received its first residents.

The prospect of incorporation first arose in 1971 and was a lingering issue until 1996, when the potential for a reduction in County services and the possibility of a commercial airport at the nearby site of the former Marine Corps Air Station, El Toro, became very real concerns. Proponents of cityhood were successful in gaining the necessary approvals and signatures to place the issue of incorporation on the ballot on March 2, 1999.

On March 24, 1999, Laguna Woods officially became Orange County's thirty-second city when the five newly elected members of the City Council were sworn in by Superior Court Judge Francisco F. Firmat.

Location and Physical Features

Laguna Woods occupies approximately three square miles of land in Orange County, California, and is bordered by the cities of Aliso Viejo, Irvine, Laguna Beach, and Laguna Hills, as well as unincorporated and undeveloped open space owned by the County of Orange and the City of Laguna Beach. Transportation routes near Laguna Woods include the Interstate 5 Freeway (I-5) and State Routes 73 (SR-73) and 133 (SR-133). Portions of SR-73 and SR-133 are operated as toll roads by the Transportation Corridor Agencies. An area map is included as **Figure 1**.

Laguna Woods was developed in a generally flat portion of the Saddleback Valley with the San Joaquin Hills to the west and the Santa Ana Mountains to the east. As a result, the terrain largely consists of gradual and varying slopes, hills, and low-lying areas. Laguna Woods is substantially built out with little natural topography remaining.

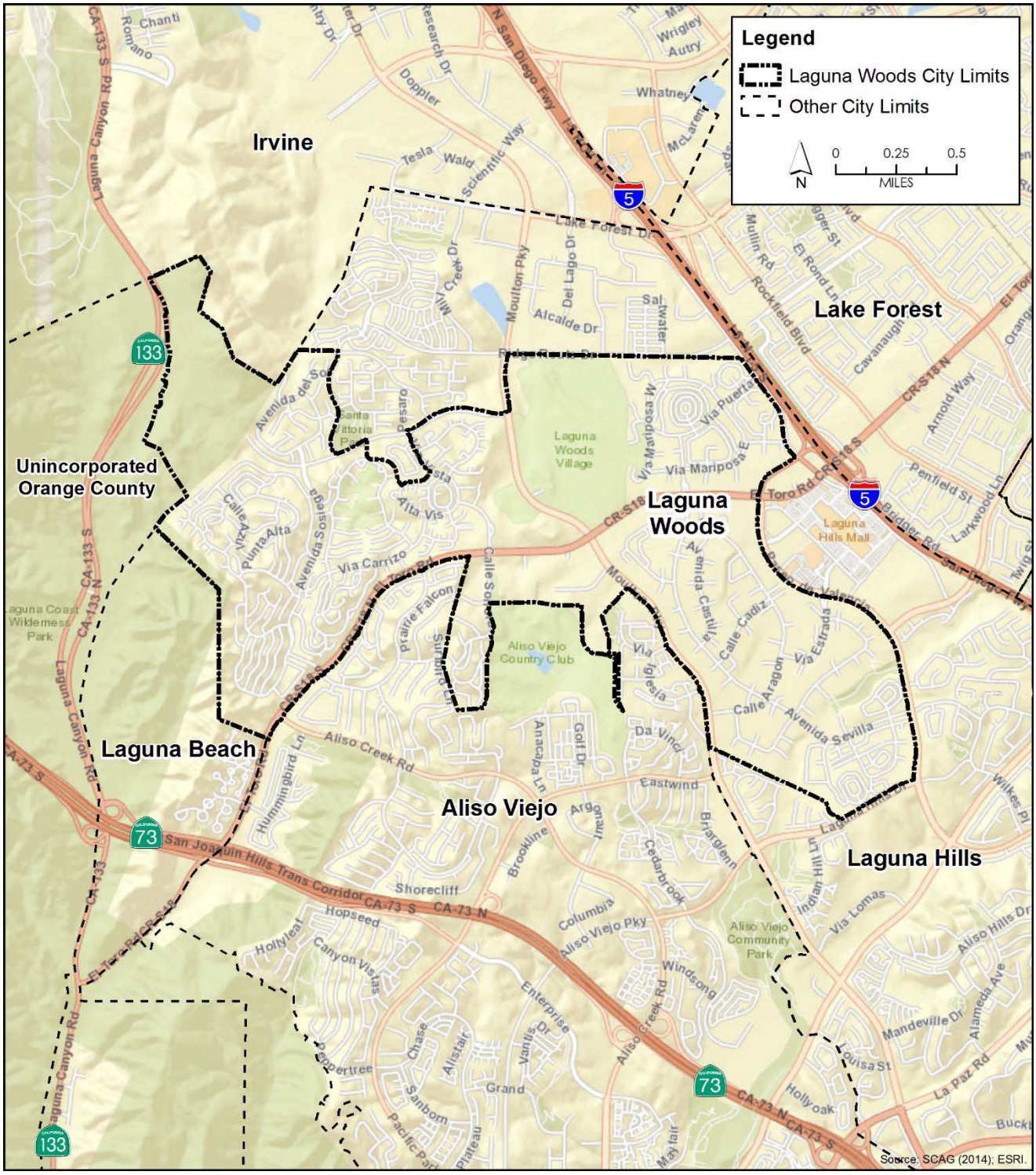
One of the most significant biological resources in Laguna Woods is Aliso Creek, which begins in the Santa Ana Mountains inside the Cleveland National Forest. The Creek traverses 19 miles to its confluence with the Pacific Ocean in Laguna Beach, transecting the southeastern portion of Laguna Woods for approximately one-half mile.

Local Government

The City of Laguna Woods is a general law city with a Council-Manager form of local government, meaning that it operates within the parameters of California municipal law with an elected City Council that is responsible for legislative and policy functions. The City Council appoints and supervises a professional City Manager charged with the day-to-day responsibilities of managing the City and implementing City Council laws and policy. The City Council also appoints a City Attorney to serve as the City's legal counsel. The five members of the City Council are residents elected at large by registered voters to four-year terms. City Council elections are held in even numbered years with two and then three members elected at subsequent elections.

In addition to the City Manager, the City of Laguna Woods has nine full-time and additional part-time staff who are responsible for delivering a full range of municipal services. The City operates as a contract city, meaning that its small in-house staff leverage the resources of a variety of contract and joint powers organizations to provide efficient and cost-effective services. A number of independent special districts, school districts, and public utilities also provide vital services to Laguna Woods residents and businesses.

Figure 1: Laguna Woods Area Map

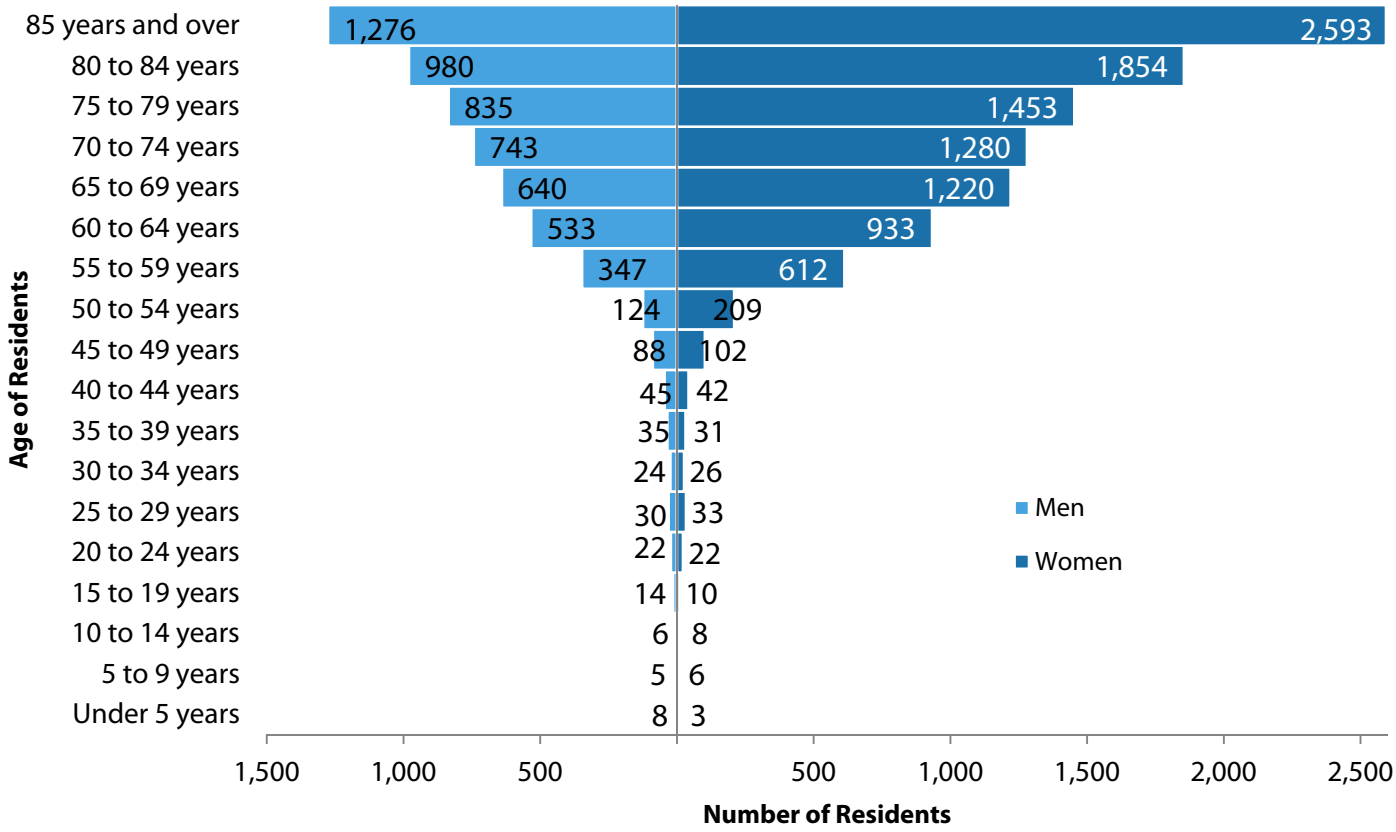


Source: SCAG (2014); ESRI

Demographics

The 2010 Census reports that 80% of Laguna Woods residents are at least 65 years of age or older, more than half of residents are at least 75 years of age or older, and roughly one-quarter of residents are at least 85 years of age or older (US Census Bureau 2010a). The median age in Laguna Woods is 77 years, more than twice that of Orange County or California (US Census Bureau 2010b) and generally consistent with the median age of 78 reported in the 2000 Census. **Figure 2** depicts the demographic distribution of Laguna Woods residents by age and gender.

Figure 2: Laguna Woods Population Pyramid, 2010

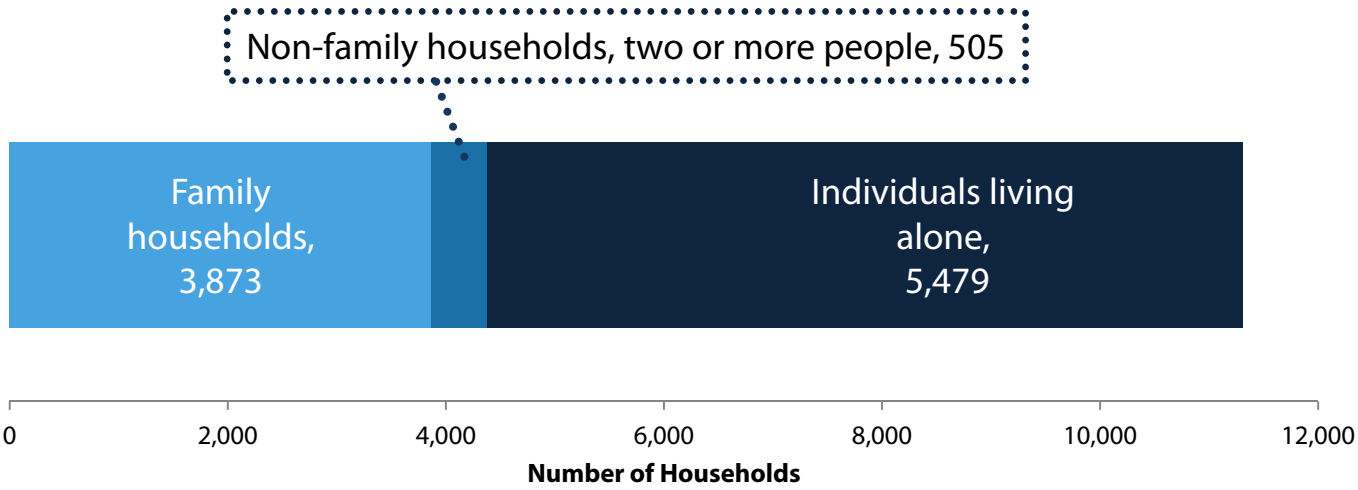


Source: US Census Bureau 2010a

The US Census Bureau's 2008–2012 American Community Survey reports that 19% of Laguna Woods residents speak a language other than English at home, with 9.3% speaking an Asian or Pacific Island language, 5.8% speaking an Indo-European language, and 3.6% speaking Spanish or Spanish Creole (US Census Bureau 2012).

As a community of primarily older adults, a substantial number of individuals live alone in Laguna Woods. **Figure 3** summarizes Laguna Woods' household composition. For the purpose of reporting, the US Census Bureau defines a household as all persons who occupy a housing unit. Family households are housing units with at least two legally related occupants and non-family households are comprised of entirely unrelated occupants. US Census data indicates that the composition of family households, non-family households, and households with persons living alone in Laguna Woods remained generally constant between 2000 and 2010.

Figure 3: Laguna Woods Household Types, 2010



Source: US Census Bureau 2010a

The US Census Bureau's 2008–2012 American Community Survey estimates Laguna Woods' median household income at $36,818 per year. As points of comparison, the median household incomes for the State of California and Orange County over the same period of time were $61,400 and $75,566, respectively. **Tables 1** and **2** provide additional household income distribution and comparative information.

Table 1: Household Income Distribution, 2008–2012

	City of Laguna Woods		Orange County	
	Number	Percentage	Number	Percentage
Less than $10,000	990	8.6%	40,527	4.1%
$10,000 to $14,999	735	6.4%	33,302	3.4%
$15,000 to $24,999	2,013	17.5%	71,092	7.2%
$25,000 to $34,999	1,719	14.9%	73,346	7.4%
$35,000 to $49,999	2,022	17.6%	108,107	10.9%
$50,000 to $74,999	1,720	15%	165,063	16.7%
$75,000 to $99,999	990	8.6%	132,919	13.4%
$100,000 to $149,999	748	6.5%	178,533	18%
$150,000 to $199,999	336	2.9%	88,066	8.9%
$200,000 or more	226	2%	99,311	10%
Total households	11,499	100%	990,266	100%

Source: US Census Bureau 2012

Table 2: Median Household Income, 2008–2012

	Median Household Income	Laguna Woods as a Percentage
City of Laguna Woods	$36,818	100%
Orange County	$75,566	49%
State of California	$61,400	60%

Source: US Census Bureau 2012

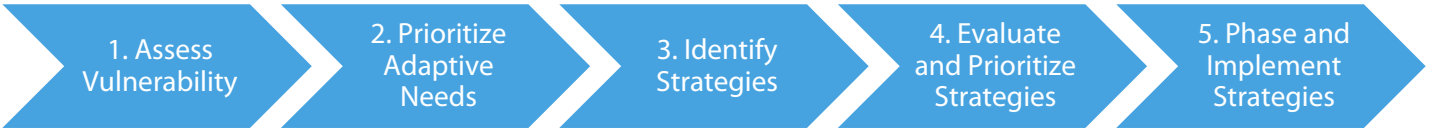
The differences in median household income between Laguna Woods residents and other residents of Orange County and California can be partially attributed to the fact that most Laguna Woods residents are either fully or partially retired with a large portion of their household income consisting of limited or highly variable "non-wage" earnings (e.g., Social Security payments, pension proceeds, and retirement investment yields).

Research indicates that nearly half of all retirees have less than $10,000 in total assets in their final year of life (Poterba, Venti, and Wise 2012). Accordingly, it is reasonable to conclude that individuals in their eighties and nineties may have household incomes significantly lower than Laguna Woods' median household income.

Adaptation Planning Process

The State of California provides climate adaptation planning guidance to cities and local governments through its California Adaptation Planning Guide (Cal OES and CNRA 2012). The Adaptation Planning Guide process starts with assessing a jurisdiction's vulnerability to climate change, continues with developing adaptation strategies that directly address that vulnerability, and finishes with an evaluation of strategy success. The process, identified in **Figure 4**, continues as the resultant climate adaptation plan is updated in the future.

Figure 4: Adaptation Planning Process


1. Assess Vulnerability
2. Prioritize Adaptive Needs
3. Identify Strategies
4. Evaluate and Prioritize Strategies
5. Phase and Implement Strategies

Source: Cal OES and CNRA 2012

To foster statewide consistency, the planning process used to develop this Plan was aligned with the California Adaptation Planning Guide process, beginning with an assessment of the primary climate change threats facing Laguna Woods (*Step 1*) and identification of the structures, functions, and populations of Laguna Woods that are expected to be most vulnerable to climate change (*Step 2*). In this Plan, steps 1 and 2 are collectively referred to as the Vulnerability Assessment and are intended to answer four questions:

1. How might climate change affect Laguna Woods (or, what climate changes is the city *exposed* to)?

2. What structures, functions, or populations in Laguna Woods could be affected by climate change (or, in the city, what is *sensitive* to climate change)?

3. How could climate change affect structures, functions, or populations in Laguna Woods and how are those assets currently prepared to deal with such impacts (or, what are the *impacts* and *adaptive capacity*)?

4. What topics and time frames should adaptation strategies address in order to maximize the public value of climate adaptation efforts (or, what is the most *vulnerable* at different *onsets*)?

The outcomes of the Vulnerability Assessment are reported in **Chapter 3**.

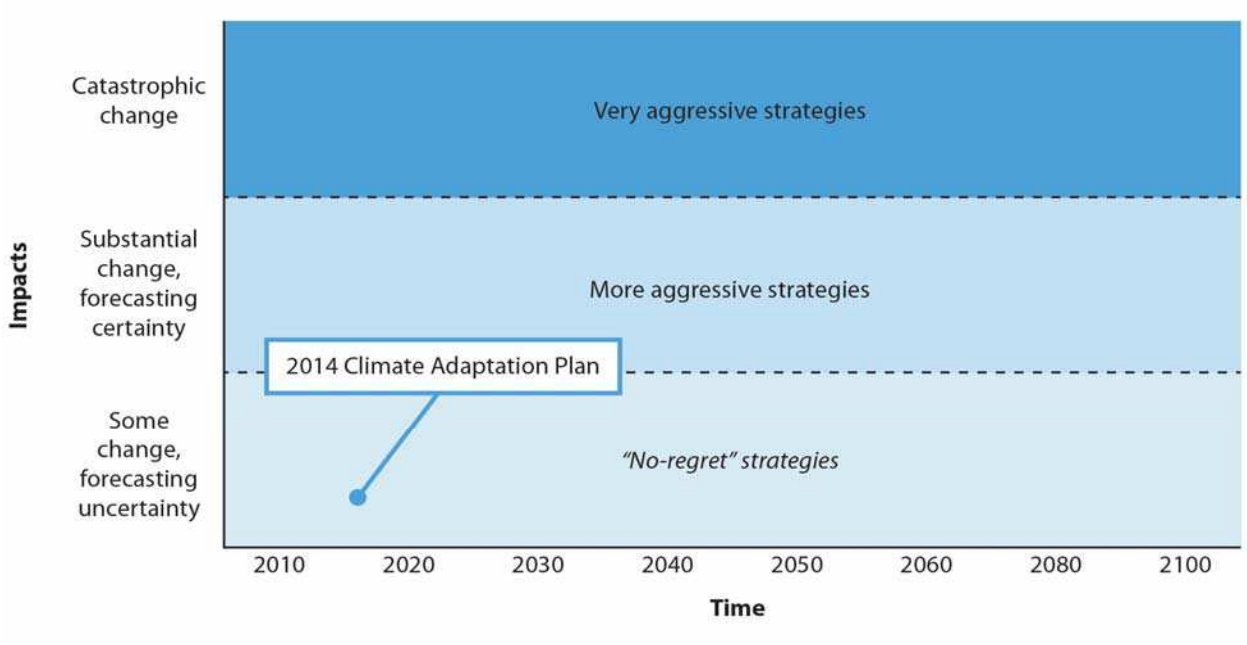
Following completion of the Vulnerability Assessment, adaptation strategies were drafted, including goals, policy objectives, and implementation actions intended to increase Laguna Woods' resilience to climate change (*Step 3*). The adaptation strategies were then evaluated for effectiveness, cost, integration with the City's existing planning framework, and ease of implementation and monitoring (*Step 4*). Information related to the adaptation strategies can be found in **Chapter 4** and **Chapter 5**.

Following adoption of this Plan by the City Council, the City will begin to implement its adaptation strategies with the goal of demonstrating progress toward achieving each of the implementation actions within five years (*Step 4*). While no statutory requirement exists with respect to the update of climate adaptation plans, the City recognizes significant compatibility and potential for synergy between climate adaptation and hazard mitigation planning processes. Accordingly, the City will complete a comprehensive update of this Plan in conjunction with each comprehensive update of its Local Hazard Mitigation Plan (*Step 5*) (**Implementation Action 3.3.2**).

"No-Regret" Strategies

Due to the high degree of uncertainty that exists with respect to local climate change exposures and impacts, this Plan emphasizes "no-regret" strategies that will produce public value regardless of how (or if) the climate continues to change. As science, best practices, and local knowledge improve, the City may consider pursuing more aggressive strategies. **Figure 5** illustrates the City's "threshold approach" to climate adaptation planning.

Figure 5: Threshold Approach to Climate Adaptation Planning

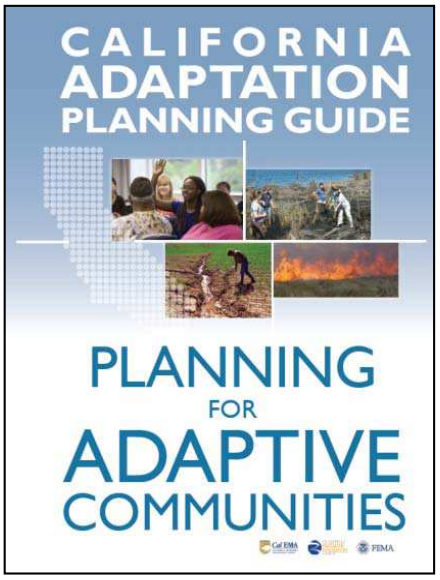


Source: PMC 2014

Data Sources

Due to the technical nature of climate change and its impacts, this Plan relies primarily on guidance provided by the State of California and scholarly research. Where there are gaps in those sources, the City uses information from national and international resources, including the federal government and the Intergovernmental Panel on Climate Change (IPCC); and, local stakeholders, particularly with respect to local implications. Key data sources include the California Adaptation Planning Guide, Cal-Adapt, US Census Bureau, scholarly research, and local and regional planning documents. A bibliography is included with this Plan for reference.

California Adaptation Planning Guide



The California Adaptation Planning Guide, dated July 2012, was prepared as a joint endeavor by the California Governor's Office of Emergency Services (Cal OES) and the California Natural Resources Agency (CNRA). Funding support was provided by the Federal Emergency Management Agency (FEMA) and the California Energy Commission (CEC). Technical support was provided by California Polytechnic State University, San Luis Obispo.

The purpose of the California Adaptation Planning Guide is to assist local and regional jurisdictions with proactively addressing unavoidable consequences of climate change. In addition to providing a process for developing climate adaptation plans, the California Adaptation Planning Guide also includes a statewide summary of climate change exposures.

While the City used the California Adaptation Planning Guide as the primary data source for this Plan, additional sources were required due to its broad scope and lack of locally specific information. Indicative of the emerging nature of climate change research, the California Adaptation Planning Guide addresses climate change exposures on a regional, as opposed to local, scale. Information relevant to Laguna Woods is presented as a part of the South Coast Region, which is described as the "most heavily urbanized in the state" and includes the entirety of Orange, Los Angeles, San Diego, and Ventura counties (collectively, more than 16 million people).

Cal-Adapt

The California Energy Commission maintains Cal-Adapt, a web-based climate adaptation planning tool that the California Adaptation Planning Guide encourages jurisdictions to use as a means of assessing potential climate change impacts over time. Cal-Adapt presents existing downscaled climate change scenarios and research in a manner that is intended to support local and regional planning efforts. Information in Cal-Adapt is drawn from the Coupled Model Intercomparison Project Phase 3 (CMIP 3), a multi-model data set that was developed for the Intergovernmental Panel on Climate Change's Fourth Assessment Report (IPCC 2007).

US Census Bureau

The US Census Bureau is a federal agency charged with producing data relative to the nation's population and economy. The City used the 2010 Census as its primary source of demographic data for this Plan. Where data was not available from the national census, the City used American Community Survey findings.

Scholarly research

The City relied heavily on peer-reviewed scholarly research to estimate climate change impacts facing Laguna Woods. While most of the available research was international, national, or regional in nature, the City made its best effort to include only research that studied conditions comparable to those in Laguna Woods.

Included amongst the scholarly research were publications from state and federal agencies (e.g., the CEC and United States Bureau of Reclamation), nongovernmental organizations (e.g., the United Nations and Bipartisan Policy Center), and academic journals (e.g., the *Journal of Public Health* and *Journal of Geophysical Research*).

Local and regional planning documents

A variety of local and regional planning documents were used to supplement international and national data and promote this Plan's local specificity. City-generated plans (e.g., the General Plan Safety Element and Local Hazard Mitigation Plan) and regional plans (e.g., the El Toro Water District's 2010 Urban Water Management Plan, Orange County Health Profile, and South Orange County Integrated Regional Water Management Plan) provided background information on climate change-related hazards and climate adaptation efforts currently underway.

Academic Engagement

Laguna Woods is one of the first non-coastal cities in California to prepare a climate adaptation plan using the California Adaptation Planning Guide. The City provided drafts of this Plan to the California Polytechnic State University professors who were the lead authors of the California Adaptation Planning Guide for the purpose of ensuring its academic defensibility and technical completeness. The drafts were well-received and modifications based on comments from the professors were incorporated throughout this Plan.

Community Engagement

Public Safety Committee Meetings

The Public Safety Committee is an 11-member standing advisory committee consisting of residents appointed by the City Council. The Public Safety Committee is subject to the provisions of the State of California's Ralph M. Brown Act and meets in an open and publicly noticed meeting with opportunities for public comment once per

month. Notices are posted at City Hall, at two public locations, and on the City's website at least 72 hours in advance of meetings. Notices are also e-mailed to individuals who have registered to receive electronic meeting notifications. During the development of this Plan, the Public Safety Committee served as the principal conduit for public-level planning support and held five climate adaptation-oriented meetings.

- **Public Safety Committee Meeting – December 2013**
  Laguna Woods City Hall, 24264 El Toro Road, Laguna Woods, CA 92637

  At the Public Safety Committee's regular meeting on December 10, 2013, Christopher Macon (City), Scott Davidson (PMC), and Chris Read (PMC) provided introductory information on the project and solicited input on issues of preliminary concern and interest. Committee members and one resident asked clarifying questions and provided social vulnerability considerations. A common theme of the comments received was a desire for Laguna Woods to become less dependent on outside resources for water and electricity. Excessive heat and humidity were identified as areas of immediate concern and activities to better inform and educate the public on personal emergency preparedness were encouraged.

  Committee members present: Jim Brauer, Irwin Chodash, Jerry Gross, Hal Horne, Kathleen Mathews, Mark Monin, David Russell Ohrn, Doug Rook, Vern Watkins, Dick Whitehead

- **Public Safety Committee Meeting – January 2014**
  Laguna Woods City Hall, 24264 El Toro Road, Laguna Woods, CA 92637

  At the Public Safety Committee's regular meeting on January 14, 2014, Bob Hill, General Manager of the El Toro Water District, provided information on the El Toro Water District's Urban Water Management Plan. Mr. Hill's presentation was made following a request from Committee members at the regular meeting on December 10, 2013. Committee members reiterated the need for increased local water independence, particularly through supply diversification and conservation.

  Committee members present: Jim Brauer, Irwin Chodash, Hal Horne, Kathleen Mathews, Mark Monin, Doug Rook, Sandy Verrall, Vern Watkins, Dick Whitehead

- **Public Safety Committee Meeting – March 2014**
  Laguna Woods City Hall, 24264 El Toro Road, Laguna Woods, CA 92637

  At the Public Safety Committee's regular meeting on March 11, 2014, Christopher Macon (City), Scott Davidson (PMC), and Chris Read (PMC) provided information on the project, including draft outcomes of this Plan's Vulnerability Assessment, and solicited input on related topics. Committee members discussed, provided feedback on, and generally concurred with the draft Vulnerability Assessment outcomes. Comments received largely focused on the need for increased water and electricity independence.

  Committee members present: Jim Brauer, Irwin Chodash, Jerry Gross, Kathleen Mathews, David Russell Ohrn, Doug Rook, Sandy Verrall, Vern Watkins, Dick Whitehead

- **Public Safety Committee Meeting – September 2014**
  Laguna Woods City Hall, 24264 El Toro Road, Laguna Woods, CA 92637

  At the Public Safety Committee's regular meeting on September 9, 2014, Christopher Macon (City) provided information on the project, including draft adaptation strategies, and solicited input on related topics.

Committee members discussed, provided feedback on, and generally concurred with the draft adaptation strategies, particularly strategies related to photovoltaic (solar) system permit streamlining.

Committee members present: Jim Brauer, Irwin Chodash, Hal Horne, Kathleen Mathews, Mark Monin, David Russell Ohrn, Doug Rook, Sandy Verrall, Vern Watkins

- **Public Safety Committee Meeting – September 2014**
  Laguna Woods City Hall, 24264 El Toro Road, Laguna Woods, CA 92637

  At the Public Safety Committee's adjourned regular meeting on September 30, 2014, Christopher Macon (City), Aaron Pfannenstiel (PMC), and Chris Read (PMC) provided information on the project and solicited input on related topics. Drafts of **Chapters 1, 3,** and **4** of this Plan were distributed with the agenda packet for the Committee and general public's review. Committee members discussed, provided feedback on, and generally concurred with the draft document. As a part of a separate agenda item, Mike Grandy, Assistant General Manager and Chief Financial Officer of the El Toro Water District, reviewed and discussed issues pertaining to the El Toro Water District's drought response and water conservation efforts.

  Committee members present: Jim Brauer, Irwin Chodash, Kathleen Mathews, Mark Monin, David Russell Ohrn, Doug Rook, Vern Watkins, Dick Whitehead

- **Public Safety Committee Meeting – December 2014**
  Laguna Woods City Hall, 24264 El Toro Road, Laguna Woods, CA 92637

  At the Public Safety Committee's regular meeting on December 9, 2014, Christopher Macon (City) reviewed the complete draft of this Plan that was distributed with the agenda packet for the Committee and general public's review and solicited input on related topics. Committee members discussed, provided feedback on, and unanimously voted to recommend that the City Council adopt this Plan. Comments received emphasized the importance of addressing extreme heat, energy, and air quality-related climate change impacts; maintaining climate adaptation efforts; forming partnerships to implement this Plan's adaptation strategies; continually improving the City's ability to quantify local climate change impacts; and, ensuring that age, gender, and other local demographics are considered in climate adaptation efforts.

  Committee members present: Jim Brauer, Irwin Chodash, Hal Horne, Kathleen Mathews, Mark Monin, David Russell Ohrn, Doug Rook, Sandy Verrall, Dick Whitehead

Subsequent to the Public Safety Committee's recommendation that the City Council adopt this Plan, City staff made a variety of minor and typographical modifications intended to promote clarity and ease of reference.

Stakeholder interviews

17 one-on-one interviews were conducted with stakeholder organizations representing a broad cross section of governmental, public health, public safety, social service, and residential interests related to climate adaptation planning (**Table 3**). The purpose of the interviews was to better understand how climate change could affect each organization's operations and planning efforts; the extent to which climate change is incorporated into existing planning efforts; and, the opportunities and barriers that exist to improving climate change resilience. Interviews were conducted via teleconference by Scott Davidson (PMC), Chris Read (PMC), and Eli Krispi (PMC).

Table 3: Record of Stakeholder Interviews Conducted

Organization	Name and Position	Date
Age Well Senior Services	Dan Palumbo Chief Operating Officer	December 20, 2013
El Toro Water District	Bob Hill General Manager	December 11, 2013
Laguna Woods Village (residential community)	Wendy Bucknum Government and Public Affairs Manager	January 29, 2014
Orange County Council of Governments	Gwenn Norton Perry Executive Director	December 9, 2014
Orange County Council on Aging	Carolina Gutierrez Richau Director, Emergency Management	January 6, 2014
Orange County Fire Authority	George Casario Battalion Chief	January 6, 2014
Orange County Fire Authority	Bryan Brice Division Chief	January 26, 2014
Orange County Health Care Agency	Helene Calvet Deputy Health Officer	December 16, 2013
Orange County Sheriff's Department/ Orange County Operational Area	Donna Boston Director, Emergency Management	December 9, 2013
Orange County Vector Control District	Amber Semrow Biologist	December 20, 2013
The Regency (residential community)	Bob Forentino Executive Director	January 30, 2014
Saddleback Memorial Medical Center	Victoria Valensky Geriatric/Family Nurse Practitioner	December 30, 2013
South Coast Air Quality Management District	Aaron Karzenstein Greenhouse Gas and Sustainability Coordinator	December 11, 2013
Southern California Association of Governments	Grieg Asher Greenhouse Gas Sustainability Project Manager	December 26, 2013
Southern California Edison	Frank Wasko Regional Manager	December 16, 2013
Southern California Water Committee	Richard Atwater Executive Director	December 23, 2013
Whispering Fountains (residential community)	Yvonne Rodriguez Resident Manager	January 27, 2014

The Southern California Gas Company and the residential communities of Las Palmas and San Sebastian were invited, but declined to participate, in stakeholder interviews.

California Adaptation Forum

In August 2014, the Local Government Commission and the State of California hosted the inaugural California Adaptation Forum in Sacramento, California. Shari L. Horne, City Councilmember, and Christopher Macon, City Manager, attended on behalf of the City to raise awareness, develop partnerships, and gather information to help guide the City's climate adaptation efforts. Keynote speakers included John Laird, Secretary of the California Natural Resources Agency, and Mary Nichols, Chairman of the California Air Resources Board. As a part of the California Adaptation Forum, the City's representatives also attended a tour of the Sacramento Delta and a "farm-to-fork-to-fuel" presentation, including a tour of the Sacramento BioDigester, which produces renewable natural gas and other products from food waste using anaerobic biodigestion technology

Relationship with Other City Plans

This Plan exists within a broader City planning framework that includes a longstanding emphasis on public safety and environmental issues. The General Plan Safety Element and the Local Hazard Mitigation Plan share significant commonality with this Plan as all seek to increase local resilience to natural hazards. The Local Hazard Mitigation Plan—which forms the foundation of the City's long-term strategy to reduce disaster losses and break the cycle of disaster, damage, reconstruction, and repeated damage—also serves as the City's Energy Assurance Plan and is further related to this Plan through shared goals of energy conservation, efficiency, and independence.

Chapter 5 includes a work plan that correlates this Plan's implementation actions with the General Plan Safety Element and the Local Hazard Mitigation Plan. As all three plans are updated over time, the City envisions that they will become increasingly complementary and aligned to form a comprehensive, long-term vision for progressive public safety and environmental improvement programs within Laguna Woods. Other long-term planning documents, including the General Plan Conservation, Open Space, and Land Use elements, are also expected to increasingly address climate adaptation (**Implementation Action 3.1.1**).

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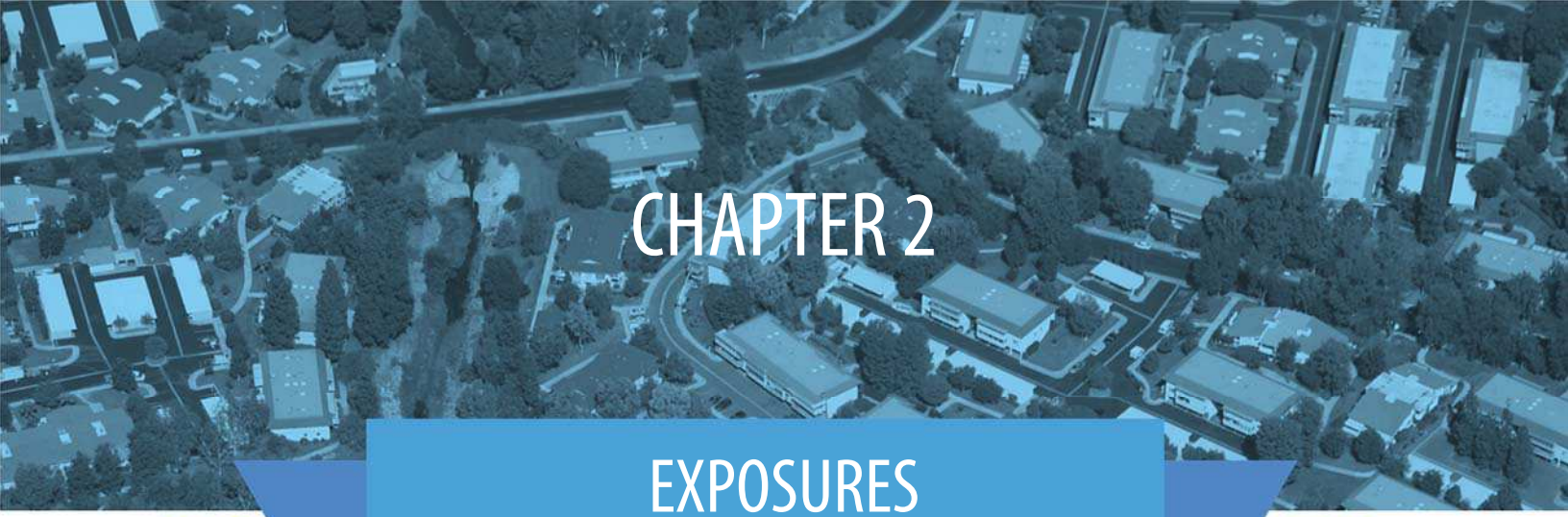


CHAPTER 2

EXPOSURES

"Exposures" are the climate changes that Laguna Woods is likely to experience based on the best available projections and data. While jurisdictions throughout California may face a variety of exposures, including sea level rise and ocean acidification, Laguna Woods' non-coastal setting, geography, and demographics cause extreme heat and resource availability to be among the most likely and impactful near-term exposures.

Exposure Projection Considerations

In order to interpret climate change exposure projections, it is important to have a clear understanding of what information is available and how it is presented. The following are considerations for exposure projections.

Exposure projections are global or regional in scale.

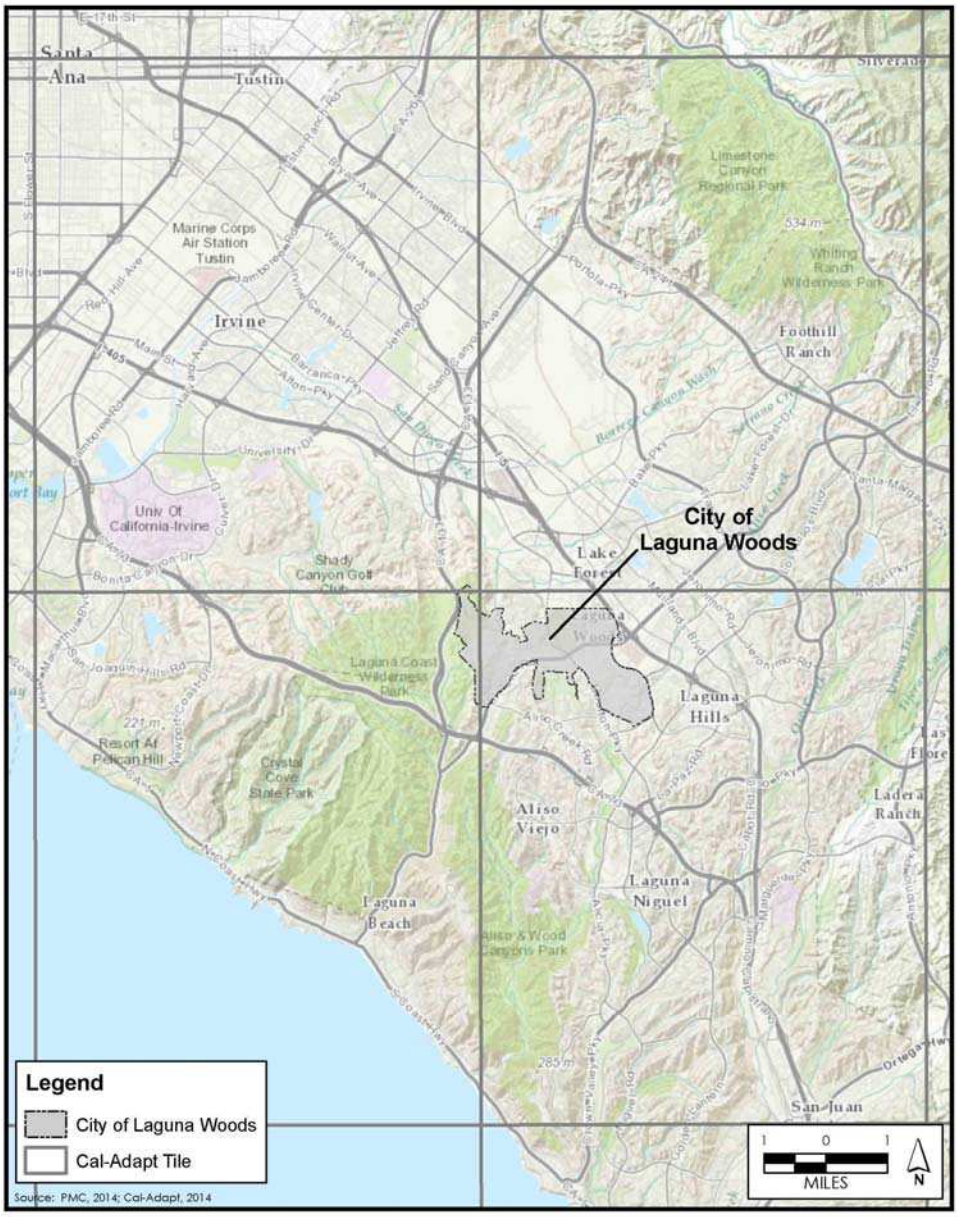
The effects of climate change are estimated using global models that project conditions at a continental or subcontinental level. For example, one set of projections may apply to the entirety of North America, while other projections are for all of South Asia. While climate change exposures are expected to vary in different parts of the world, there are general projections that scientists expect to apply globally:

- Air temperatures are expected to increase, with temperatures increasing faster over land than over water. Incidents of extreme heat are very likely to become more frequent and extreme cold events are very likely to become less frequent (IPCC 2013).
- Areas that already receive a significant amount of precipitation are likely to see more, while areas that do not receive a significant amount of precipitation are expected to see less. Extreme precipitation events are very likely to become more frequent and more intense in most places (IPCC 2013).
- Large amounts of ice in the Arctic and Antarctic are expected to melt as a result of higher temperatures. The melting ice is very likely to contribute to sea level rise (IPCC 2013).

While the California Adaptation Planning Guide and Cal-Adapt provide downscaled projections for use in local and regional planning efforts, the scale of the available data remains far broader than Laguna Woods.

In general, Cal-Adapt offers the most "local" data; however, that data is presented in tiles of approximately 60 square miles in size. Given the varied topography, urbanization, and geography of the areas surrounding Laguna Woods, and the fact that Laguna Woods occupies portions of three different tiles (**Figure 6**), future climate conditions are likely to vary somewhat from the projections discussed in this Plan. As the majority of structures, functions, and populations in Laguna Woods are located in the lower right tile shown in **Figure 6**, and as projections between the three tiles do not vary substantially, this Plan references projections specific to the lower right tile only. Such interpolation of regional data will remain necessary until there are scientific studies or models that project future climate conditions specifically for Laguna Woods.

Figure 6: Cal-Adapt Subregion Size Demonstration



Source: PMC 2014, Cal-Adapt 2014

Exposure projections are useful for planning, but contain some uncertainty.

Climate change is caused by an increase in the concentrations of greenhouse gases in the atmosphere. How severe the impacts of climate change may be in the future and the rate at which those impacts may occur depend in large part on the rate of future greenhouse gas emissions. A number of factors affect greenhouse gas emissions, including population, economic activity, individual behavior, and government policy, projections of which are ultimately theoretical. Consistent with the California Adaptation Planning Guide, this Plan considers possible climate changes from both low and high emissions scenarios.

In addition to the uncertainty associated with greenhouse gas emissions, exposure projection models tend to agree on basic trends, but vary in actual projections due to differing assumptions about how parts of the global climate interact. As a result, all of the exposure projections discussed in this Plan have levels of uncertainty and probability associated with them. This Plan presents probability in qualitative terms (e.g., unlikely, likely, very likely), which correspond to the quantitative probability levels listed in **Table 4**.

Irrespective of issues of uncertainty, it is important to note that this Plan emphasizes "no-regret" strategies that will produce public value regardless of how (or if) the climate continues to change. While greenhouse gas emissions are contextually relevant to climate adaptation planning, this Plan is not intended to reduce greenhouse gas emissions or assign fault with respect to greenhouse gas emissions generation.

Table 4: Exposure Probability Levels

Term	Probability Level
Very likely	90–100%
Likely	66–100%
More likely than not	50–100%
About as likely as not	33–66%
Unlikely	0–33%
Very unlikely	0–10%

Source: IPCC 2013

Exposure projections are not weather forecasts.

This Plan discusses climate change exposure projections, not weather forecasts. "Weather" is a short-term description of atmospheric conditions at a particular location at a particular time, whereas "climate" is a long-term average description of atmospheric conditions (IPCC 2007). In other words, climate is a fairly predictable description of what can generally be expected to occur, while weather is a much less predictable description of what actually occurs. Weather may be similar to climatic averages, or may be substantively different, as it is expected to vary from day to day, month to month, and year to year. For example, in any given year, variability in weather means that rainfall levels in Laguna Woods may be less than 5 inches or close to 30 inches, but climate projections for Laguna Woods say that, *on average*, the community will see slightly less than 13 inches of rainfall per year (Western Regional Climate Center 2013a; Western Regional Climate Center 2013b).

Climate changes are gradual and long-term.

Climate is a long-term average that does not change quickly. The Intergovernmental Panel on Climate Change finds with very high confidence that the present rate of climate change is unprecedented as compared to the past 22,000 years and with medium confidence that it is unprecedented as compared to the past 800,000 years (IPCC 2013). Even with unprecedented climate change, differences in the climate may be indistinguishable from one year to the next and may only be discernible when compared across multiple decades.

Although this Plan discusses projected climate changes for specific years and time frames (e.g., what average temperatures are likely to be in 2050), it does not mean that temperatures will remain constant at current levels until 2049 and then suddenly increase the following year. Like other exposures, temperatures are expected to increase gradually from current to projected levels. There is some contrary research that indicates that climate changes could occur relatively rapidly once certain "tipping points" are met (Alley et al. 2003; Lenton et al. 2007); however, those views are considered to hold a high degree of uncertainty (IPCC 2013).

Local Climate Change Exposures

The following exposures may impact Laguna Woods:

Table 5: Exposure Key

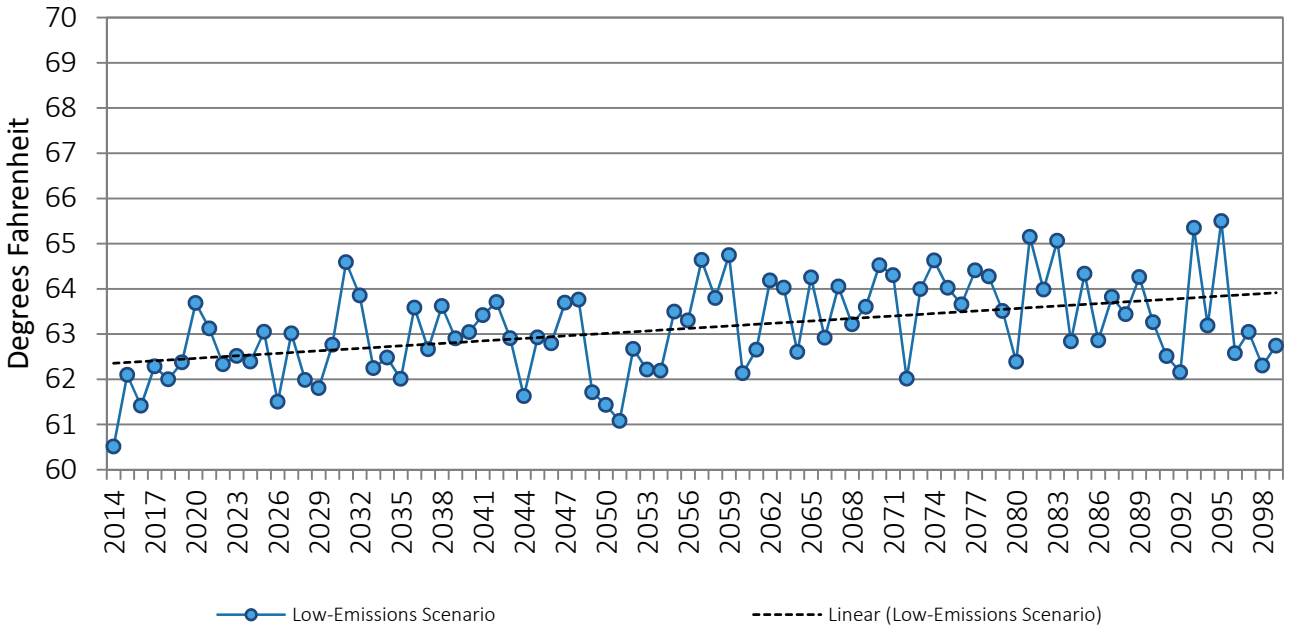
H1: Average temperature	WI1: Wind
H2: Heat waves	WF1: Local wildfires
P1: Annual precipitation	WF2: Regional wildfires
P2: Extreme storms	W1: Water availability

H1: Average temperatures could steadily increase.

Climate change is expected to affect the average temperatures in Laguna Woods. Over the period of 1915 through 2003, Laguna Woods has experienced an average mean temperature of 62.2°F and an average high temperature of 75.4°F (Western Regional Climate Center 2013a; Western Regional Climate Center 2013b). By 2020, the California Adaptation Planning Guide projects that average mean temperatures will increase 0.6 to 1.7°F above historical levels, with average high temperatures increasing 0.3 to 2.8°F. By 2050, the average mean temperature is expected to be 2.7 to 3.0°F above historical levels, while the average high temperature is expected to increase 3.0 to 3.4°F compared to historical levels. By 2099, the California Adaptation Planning Guide

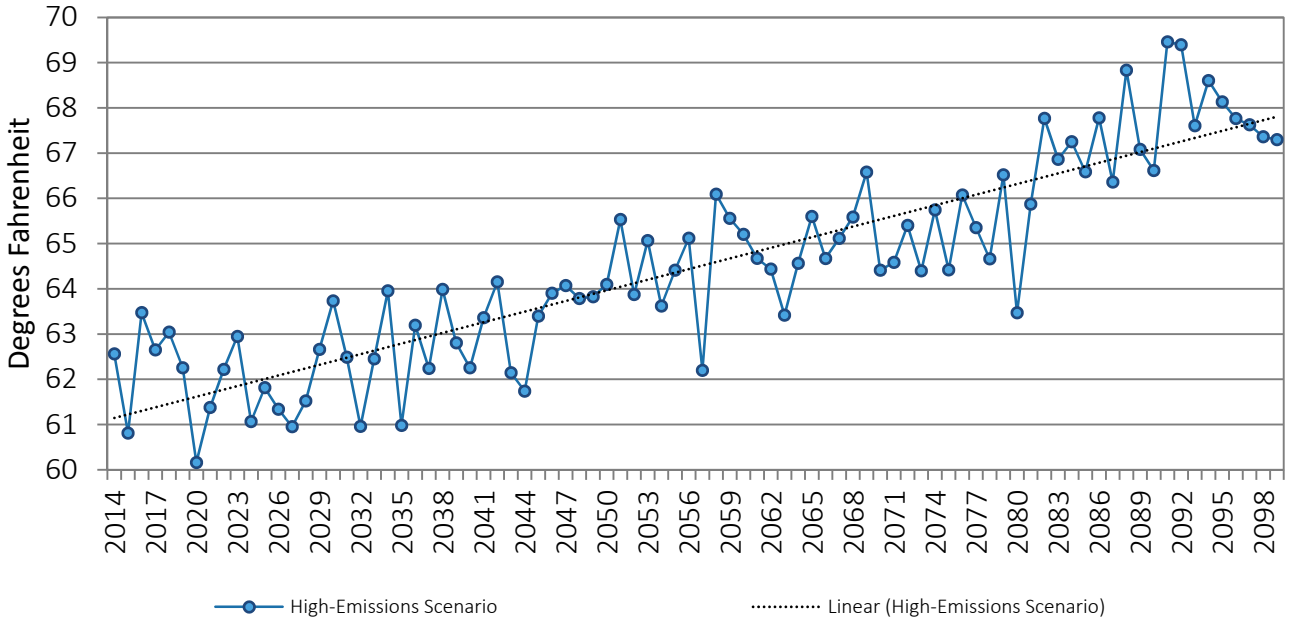
projects that average mean temperatures will increase 3.3 to 6.3°F above historical levels, with average high temperatures increasing 3.8 to 6.4°F. **Figures 7** and **8** show the projected increase in average mean temperature from 2014 to 2099 for both low and high emissions scenarios.

Figure 7: Projected Average Mean Temperatures, Low Emissions Scenario, 2014–2099



Source: Cal OES and CNRA 2012

Figure 8: Projected Average Mean Temperatures, High Emissions Scenario, 2014–2099

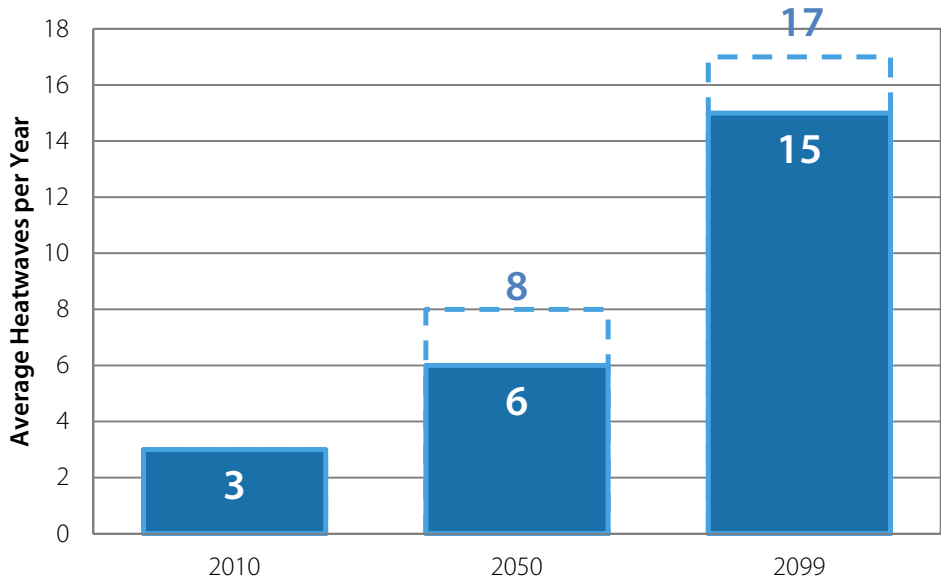


Source: Cal OES and CNRA 2012

H2: Extreme heat and heat waves could increase in frequency and severity.

In Laguna Woods, "extreme heat" is considered a high temperature of at least 85°F (Cal OES and CNRA 2012). Currently, Laguna Woods experiences an average of three heat waves, or five consecutive days of extreme heat, per year, although some years over the past decades have seen as few as one or as many as seven heat waves (Cal OES and CNRA 2012; CEC 2013; Tamrazian et al. 2008). **Figure 9** shows that the number of heat waves in Laguna Woods is very likely to increase as a result of climate change, reflecting the global trend. By 2050, the California Adaptation Planning Guide projects that Laguna Woods will experience an average of three to five additional heat waves per year, or approximately double current levels. By 2099, the California Adaptation Planning Guide projects an average of 12 to 14 additional heat waves per year.

Figure 9: Projected Heat Waves per Year



Source: Cal OES and CNRA 2012

P1: Annual precipitation could decrease.

Between 1915 and 2003, average precipitation in Laguna Woods was approximately 12.86 inches per year; however, there was often substantial variability in precipitation between any two years (Western Regional Climate Center 2013a; Western Regional Climate Center 2013b). The California Adaptation Planning Guide and Cal-Adapt project that the coastal counties of Southern California, including Orange County, are likely to experience a decrease in precipitation as a result of climate change. Precipitation in Laguna Woods is projected to decrease two inches below historical levels by 2050 and by three to five inches below historical levels by 2099. While a decrease in precipitation is considered the more plausible result of climate change, there remains a 0 to 10% chance that precipitation levels will increase (IPCC 2013). Precipitation variability has been an issue of recent concern for Laguna Woods and much of California, as precipitation levels have been unusually low since 2012 and 2014 is expected to be the driest year for the state in recorded history. In January 2014, Governor Brown declared a state of emergency and called for a 20% statewide reduction in water use. In his emergency declaration, Governor Brown wrote that droughts could occur "more regularly into the future, based on scientific projections regarding the impact of climate change" (California Office of the Governor 2014).

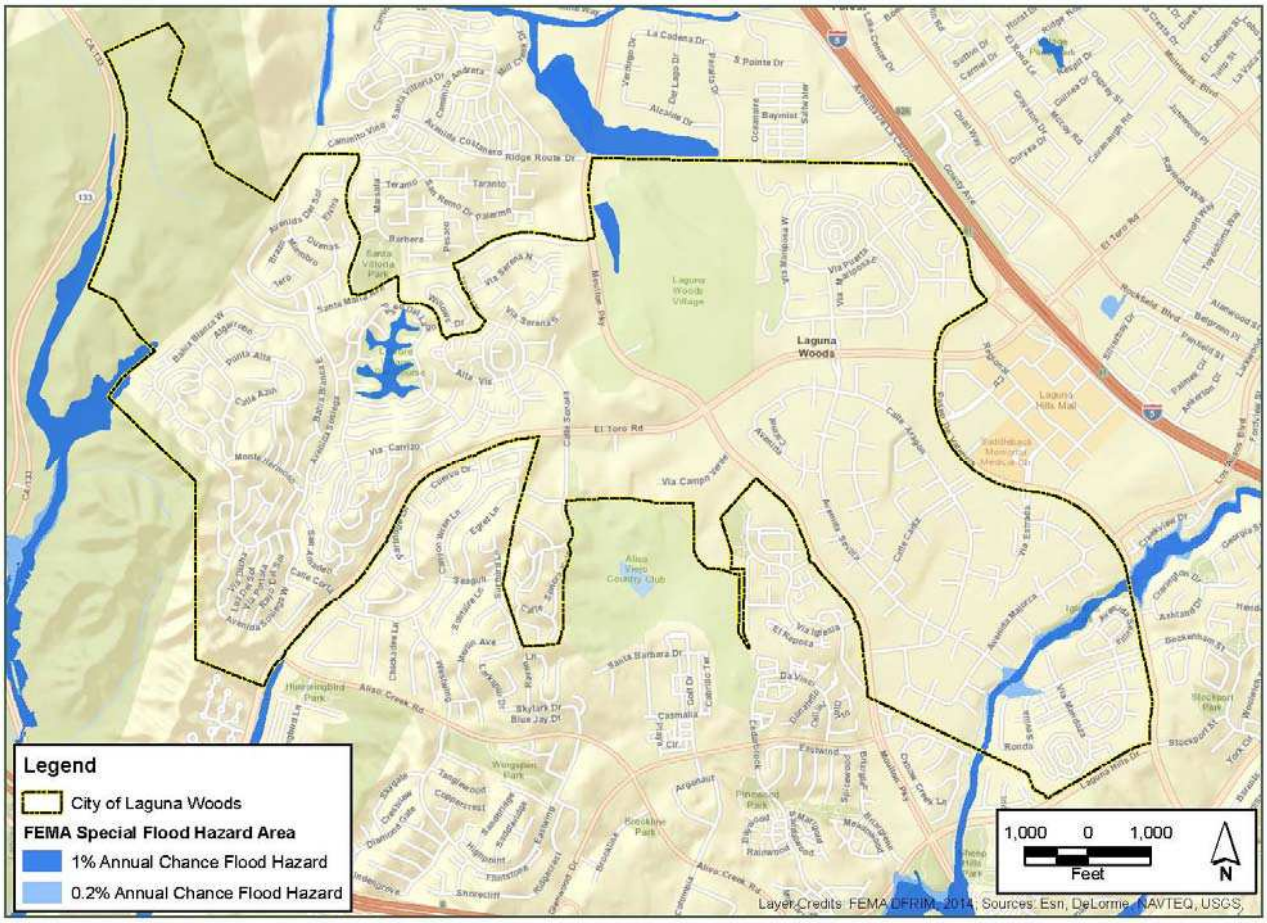
P2: Extreme storms and flooding could increase.

Although Laguna Woods may experience a decrease in precipitation levels due to climate change, this does not necessarily mean that the frequency or intensity of storms and flooding will follow a similar trend. A meteorological phenomenon known as the "atmospheric river" (a narrow stream of extremely moist air) is frequently responsible for the more intense storms that strike California. Atmospheric rivers generally deliver up to 50% of the state's total precipitation in any given year. Recently, California has experienced an average of four atmospheric river storms per year, although some years have seen significantly more (20 atmospheric river storms occurred in the winter of 2010–2011). A particularly intense atmospheric river storm was responsible for the December 2010 flooding in Laguna Woods (Earth System Research Laboratory, n.d.).

Atmospheric rivers are expected to strengthen as a result of climate change, and while there is not yet scientific consensus, recent studies suggest that stronger atmospheric rivers could increase the number of extreme storms that California experiences by 20 or more per year (Dettinger 2012; Rajagopalan 2013). Additionally, there is some indication that the most powerful storms may increase in intensity (Dettinger, Das, and Cayan, n.d.).

Figure 10 shows the areas of Laguna Woods that are located in Special Flood Hazard Areas designated by the Federal Emergency Management Agency (FEMA). Although other areas of Laguna Woods may flood, Special Flood Hazard Areas are considered to be particularly susceptible.

Figure 10: City of Laguna Woods 100- and 500-Year Floodplains



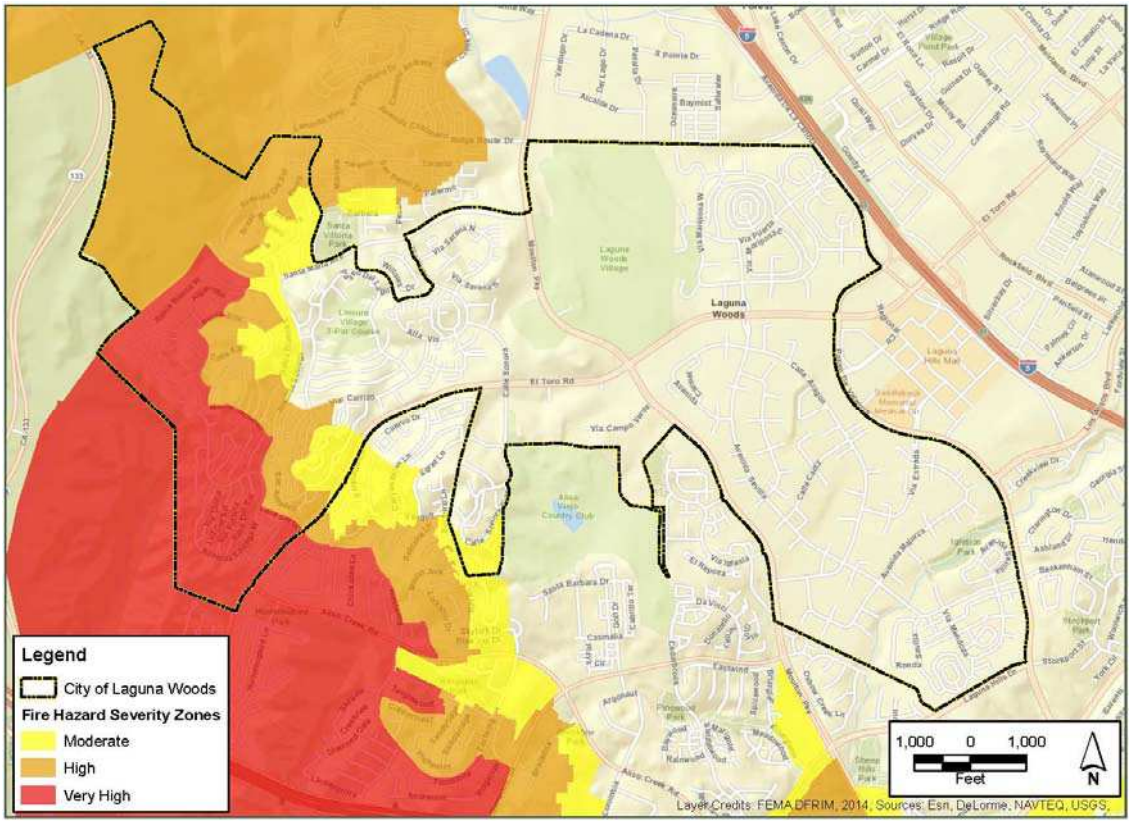
WI1: Wind speeds and types could be affected by climate change.

Wind speeds in Laguna Woods average 4 to 6 miles per hour (Western Regional Climate Center 2007). Annual maximum wind gusts averaged 56 miles per hour between 1948 and 1998, although in certain years maximum gusts were as low as 31 miles per hour and as high as 82 miles per hour (Structural Engineers Association of Southern California 2010). Some studies have been conducted on how climate change may affect Southern California winds, although the results are mixed (Pryor et al. 2009; Rasmussen, Holloway, and Nemet 2010). One recent study observed that average wind speeds along the coast of California may increase by up to 2.2 miles per hour (Stephens 2008), while another study suggests that climate change will not be strong enough to affect wind patterns in a significant way (Rasmussen, Holloway, and Nemet 2011). There is insufficient evidence to determine how (if at all) climate change will affect Santa Ana wind conditions; however, research on potential wind damage and wind-aided spread of wildfires (CEC 2006, 2009b) should be monitored.

WF1: Local wildfire risks could increase.

As noted in the City's Local Hazard Mitigation Plan (2013), "Wildfires… pose a very significant risk to the City with high probability and impacts," particularly in high fire hazard severity zones (**Figure 11**). Some uncertainty remains about how climate change could affect the risk of wildfires (Westerling and Bryant 2007), as there are a number of interrelated factors (e.g., wind, precipitation, and temperature). One study reports that wildfire risk may rise substantially in coastal Southern California if higher temperatures cause the native chaparral and scrub ecosystems to turn to grasslands (CEC 2009). The California Adaptation Planning Guide and Cal-Adapt report that the overall risk of fires in Laguna Woods will rise only by an undefined and minor amount, if at all.

Figure 11: City of Laguna Woods Fire Hazard Severity Zones



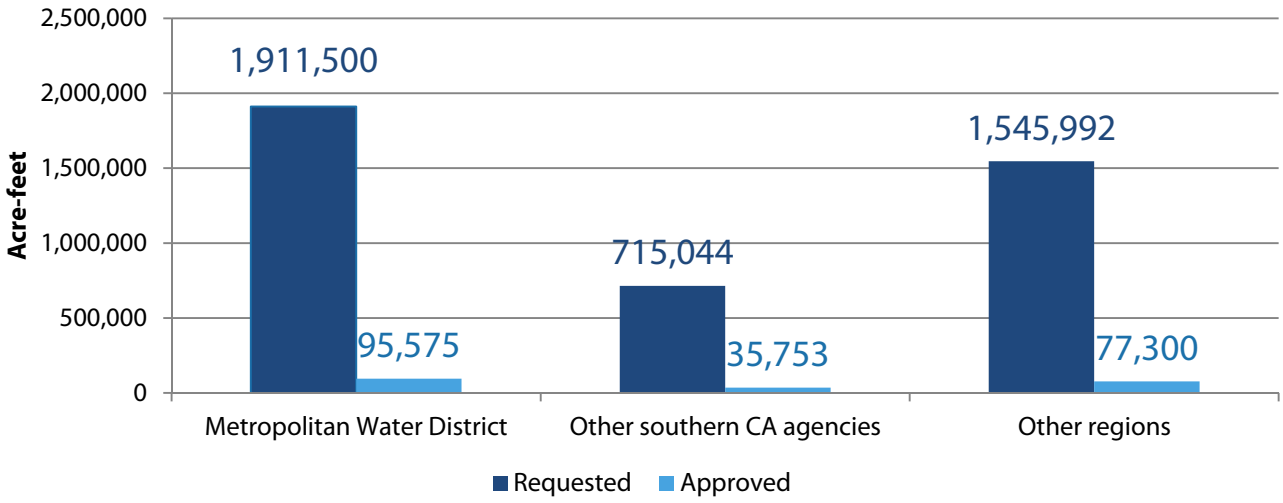
WF2: Regional wildfires may become an increasing threat.

While climate change is not expected to substantively alter the risk of wildfires directly affecting Laguna Woods, the California Adaptation Planning Guide projects that climate change may increase wildfire risk elsewhere in Southern California, which could have secondary consequences for Laguna Woods. Wildfires release smoke, ash, and other particulate matter that can significantly degrade air quality. According to the California Adaptation Planning Guide, it is likely that parts of Riverside and San Bernardino counties (which, like Laguna Woods, are located in the South Coast Air Basin) will see their wildfire risk increase by as much as 50 to 100%. Some studies suggest that by 2070 to 2099, the overall risk of wildfires in Southern California could decrease by as much as 29% or increase by as much as 28% (Westerling and Bryant 2007).

W1: Water supplies will be strained and face increasing uncertainty.

All potable water consumed in Laguna Woods is imported (El Toro Water District 2011). Although the El Toro Water District is committed to developing local water resources, Laguna Woods will continue to be dependent on imported potable water from both the State Water Project and the Colorado River Basin for the foreseeable future. That dependence means that changes to precipitation levels, snowpack, or water demand in the northern Sierra Nevada or Colorado River Basin can have an effect on water availability. As shown in **Figure 12**, in 2014, statewide variables resulted in the Metropolitan Water District, which provides State Water Project water to the El Toro Water District, receiving only 5% of the total amount of State Water Project water requested.

Figure 12: Requested and Approved State Water Project Allocations, 2014



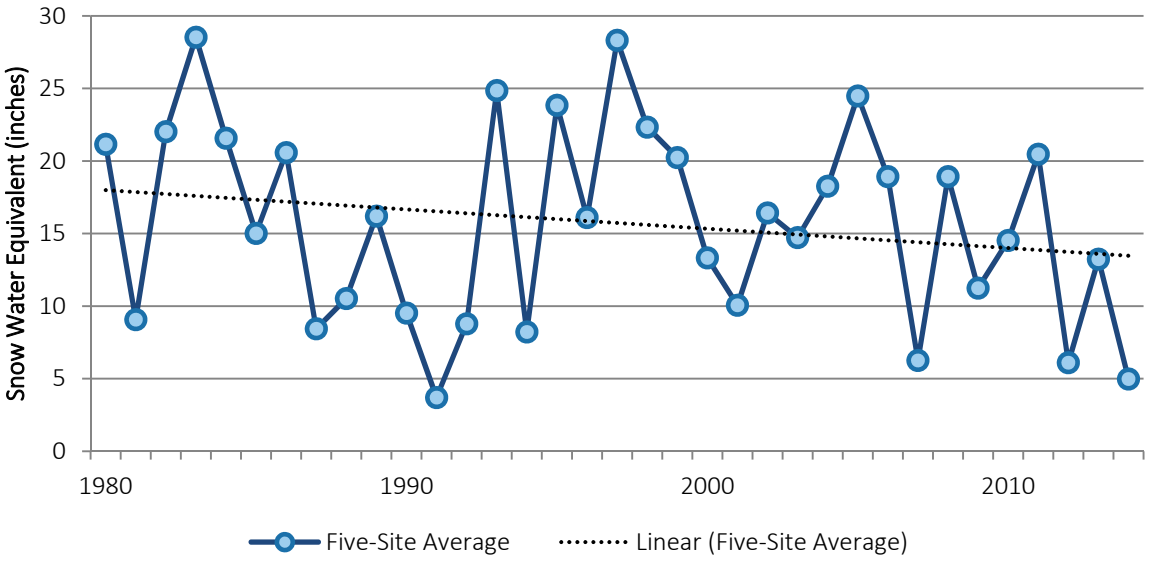
Source: Cal DWR 2014c

The California Adaptation Planning Guide projects that average precipitation in the northern Sierra Nevada will decrease by 3 to 5 inches by 2050 and by 6 to 10 inches by 2099. Similarly, in the southern Sierra Nevada, average precipitation is projected to decrease by as much as 4 inches by 2050 and by as much as 15 inches by 2099. In contrast, precipitation levels are not expected to change by any significant degree for the Colorado River Basin as a whole, although there may be small, localized fluctuations (Colorado Water Conservation Board 2012).

The California Adaptation Planning Guide projects that snowpack (the accumulation of snow that melts and runs off into rivers during the spring and summer months, continuing to supply water during times when California

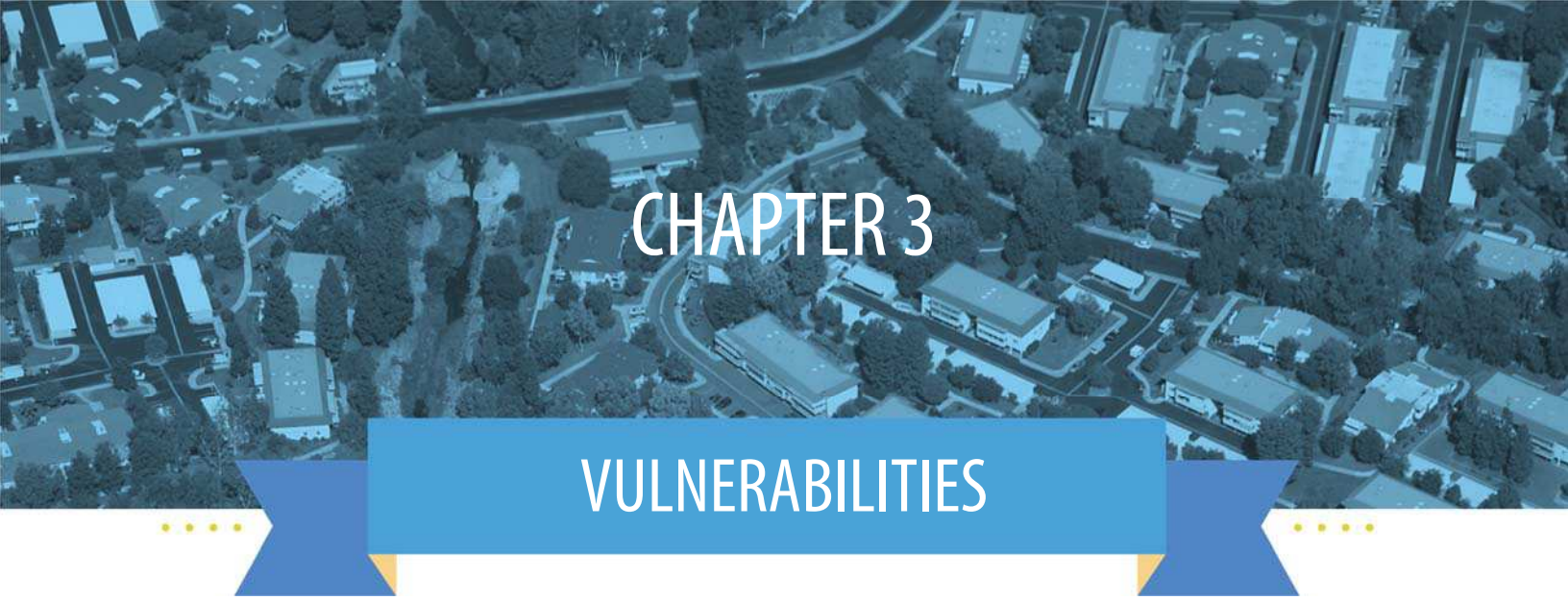
generally receives little or no rain) will decrease in the Sierra Nevada. By 2090, it is considered very likely that snowpack volume will decrease by 50 to 60%. **Figure 13** shows the mean February snowpack volume, averaged across the Sierra Nevada's Cedar Pass, Lobdell Lake, Sonora Pass, Virginia Lake Ridge, and Ward Creek monitoring sites, since 1980. Despite the high year-to-year variability, there has been a general decline in snowpack levels of approximately five inches over the past several decades. Snowpack volume is also expected to decline in the Colorado River Basin, resulting in a 9% decline in the total flow of the Colorado River (USBR 2011).

Figure 13: February 2014 Snowpack Levels in the Sierra Nevada, Five-Site Average, 1980–2014



Source: Natural Resources Conservation Service 2014

On January 17, 2014, Governor Brown declared a state of emergency regarding drought conditions in California. At the time of the announcement, the volume of the Sierra Nevada snowpack was approximately 14% of normal (Cal DWR 2014a). Despite multiple storms in February 2014, drought conditions persisted. As of the end of May 2014, all of California was in a state of at least "severe" drought and more than 75% of the state was in a condition of "extreme" or "exceptional" drought (National Drought Mitigation Center 2014). At the same time, the volume of the Sierra Nevada snowpack had decreased to less than 10% of normal (Cal DWR 2014a) and water stored in Lake Oroville, the major reservoir for the State Water Project, was at 58% of normal (Cal DWR 2014b).



CHAPTER 3

VULNERABILITIES

Climate change could significantly impact Laguna Woods. This Climate Adaptation Plan references projections based on extensive scientific study that provide a reasonable range of potential future conditions (or, "impacts") to plan for. Each potential climate change impact could affect a variety of structures, functions, and populations (or, "sensitivities") within Laguna Woods to varying extents. Vulnerability to climate change is based on a number of factors, including the risk of damage and the ability of each structure, function, or population to adjust to a new climate.

This chapter presents the outcomes of the Vulnerability Assessment.

Vulnerability Assessment Outcomes

The following Vulnerability Assessment outcomes are primary considerations for adaptation strategies.

Older adults are extremely vulnerable to climate change impacts.

Almost one-quarter of Laguna Woods residents (approximately 3,800 residents) are 85 years of age or older (US Census Bureau 2010b) and approximately 56% are 75 years of age or older (US Census Bureau 2010a). Much of the scholarly work that was reviewed for this Plan, related to age and climate change impacts, noted that as individuals age into their eighties, they become more susceptible to those impacts and are less able to adapt on their own (Gamble et al. 2013). Representatives from Age Well Senior Services (a primary social services provider for Laguna Woods residents), the Orange County Council on Aging (a countywide agency formed pursuant to the federal Older Americans Act), and the Orange County Health Care Agency (the County of Orange's health department) confirmed that at the local level, aging in place—particularly as individuals reach their eighties—drastically increases vulnerability to climate change impacts.

Significant concerns for older adults include limited financial wealth, cognitive impairment, dependence on medications and medical apparatuses, limited access to lifelines, and likelihood of social isolation (Gamble et al. 2013). Those factors are predictors of vulnerability to climate change exposures such as extreme heat and severe

weather. Individuals 85 years of age and older are also more likely to suffer detrimental effects of wildfire-caused air quality degradation (e.g., respiratory ailments) and West Nile Virus (e.g., neurologic issues).

In addition to being increasingly vulnerable to climate change exposures, older residents are also more likely to have financial challenges or uncertainty as a result of unexpected medical costs or higher than expected living costs. With approximately 70% of households in Laguna Woods considered extremely low, very low, or low income (City of Laguna Woods 2014), such financial difficulties could be widespread. As climate change leads to potentially higher food prices, as well as higher costs of living due to an increased need for heating and cooling, older adults living on fixed incomes are likely to be among the least able to adapt.

Extreme heat is the most likely and impactful near-term climate change exposure.

Extreme heat (heat waves) is the most likely climate change exposure facing Laguna Woods and among the climate change exposures with the highest degree of certainty regarding future change. Heat waves regularly impact Laguna Woods and those impacts are very likely to become more severe as time passes (Cal OES and CNRA 2012; CEC 2013). Although it appears that a generally adequate social and physical infrastructure is in place to respond to the current number of heat waves, public and private resources could be severely strained as the number of occurrences increase. According to the California Adaptation Planning Guide, local heat waves are likely to occur much more frequently, from an average of three annually at present to as many as 17 annually by 2099. Older adults, particularly those 85 years of age or older, are more likely to experience respiratory and/or cardiovascular health complications than younger individuals, and are also more likely to live alone with a fixed income and limited mobility, all of which can exacerbate the risk of extreme heat (Gamble et al. 2013).

The built environment provides many challenges and opportunities.

The built environment of Laguna Woods has several significant adaptation-related features, both positive and negative, some of which can be leveraged to maximize the public value of climate adaptation efforts.

- Laguna Woods is essentially built out and approximately 90% of its housing units are 40 years old or more. Older housing units were not built in conformance with current energy efficiency standards and may be especially vulnerable to climate change exposures such as higher average temperatures and extreme heat. Many of the multi-family housing units were built without individual water meters, which complicates the effectiveness of water conservation efforts.

- The organization of Laguna Woods into distinct private residential communities serves to socially integrate neighbors, but may do so at the expense of citywide social integration. That same community structure, however, presents opportunities to efficiently provide services to vulnerable populations and helps create a centralized communication system for addressing climate adaptation issues.

- The majority of land and infrastructure within Laguna Woods is privately owned, which greatly limits the City's ability to take direct steps to increase the built environment's resilience to climate change. Therefore, the City's adaptation strategies are largely focused on creating a political and regulatory environment that supports climate adaptation and is conducive to efforts being undertaken by private parties.

- Laguna Woods has numerous public and private transportation options, including a multimodal trail system for pedestrians, golf carts, and bicyclists (maintained by the City) and private bus/van services for private community residents, which could provide lifeline resources during emergency events.

- The El Toro Water District, which provides water and sewer services for the entirety of Laguna Woods, offers and is presently engaged in a significant expansion of its recycled water system. In addition to increasing the community's resource independence by decreasing the demand for imported water, the provision of recycled water creates opportunities to make landscaped areas more resilient to climate change exposures including higher average temperatures, extreme heat, and decreased annual precipitation.

- Public and private commitments to preventive infrastructure maintenance can help to reduce potential damage from climate change exposures, including wildfires, extreme storms, and high winds.

The City and regional partners have already begun climate adaptation work, and Laguna Woods is well prepared to continue and expand upon existing efforts.

Climate change is a local, regional, national, and global issue. Due to the interconnected, multi-disciplinary, and multi-jurisdictional efforts required to comprehensively adapt to climate change, an individual city has limited abilities to adapt entirely on its own. In Laguna Woods, the abundance of privately owned property creates a somewhat atypical environment in which the City's ability to effect change primarily relates to the incentivization and facilitation of climate adaptation work by third parties.

Climate adapation-related work occuring locally includes, but is not limited to, the following:

- City of Laguna Woods – The City is committed to comprehensive and forward-looking environmental and public safety planning efforts, as evidenced by the adoption and ongoing implementation of this Plan and the Local Hazard Mitigation Plan (which also functions as the City's Local Energy Assurance Plan). The City is also in the process of updating its General Plan Conservation Element and is expected to begin the process of updating the balance of its General Plan during the 2015-16 fiscal year. The long-term vision and strategy generated by such efforts positions the City well to maintain its services in the face of climate change and provide leadership and opportunities for third-party efforts. In addition to planning efforts, the City:

    - Opens City Hall as a public "cooling center" during extreme heat events.

    - Offers a residential energy efficiency retrofit program for lower-income residents, which provides zero-match funding for improvements such as dual-pane windows and heat pumps.

    - Enforces the Green Building Standards Code, a water-efficient landscape ordinance (conforming to the requirements of Assembly Bill 1881), and other environmentally-oriented State-mandated codes.

    - Maintains and periodically exercises Point of Dispensing (POD) emergency plans, which have been successfully used in other jurisdictions to distribute emergency rations of drinking water.

    - Provides programs intended to support mobility for older adults, including a subsidized transportation program with a particular focus on reduced rates for non-emergency medical transportation, as well as a multimodal trail network that facilitates walkability, bikeability, and golf cart travel.

- County of Orange (Orange County Sheriff's Department/Orange County Operational Area and Orange County Health Care Agency) – The County of Orange maintains and periodically exercises an extreme heat response plan and a warning system to inform cities and individuals about public health issues.

- Orange County Vector Control District – The Orange County Vector Control District monitors mosquito habitat and related outbreaks of vector-borne diseases. A particular focus is on tracking the West Nile Virus (a disease spread by mosquitoes, which thrive in warmer climate conditions), identifying areas where the West Nile Virus could spread as a result of climate change, and taking abatement action.

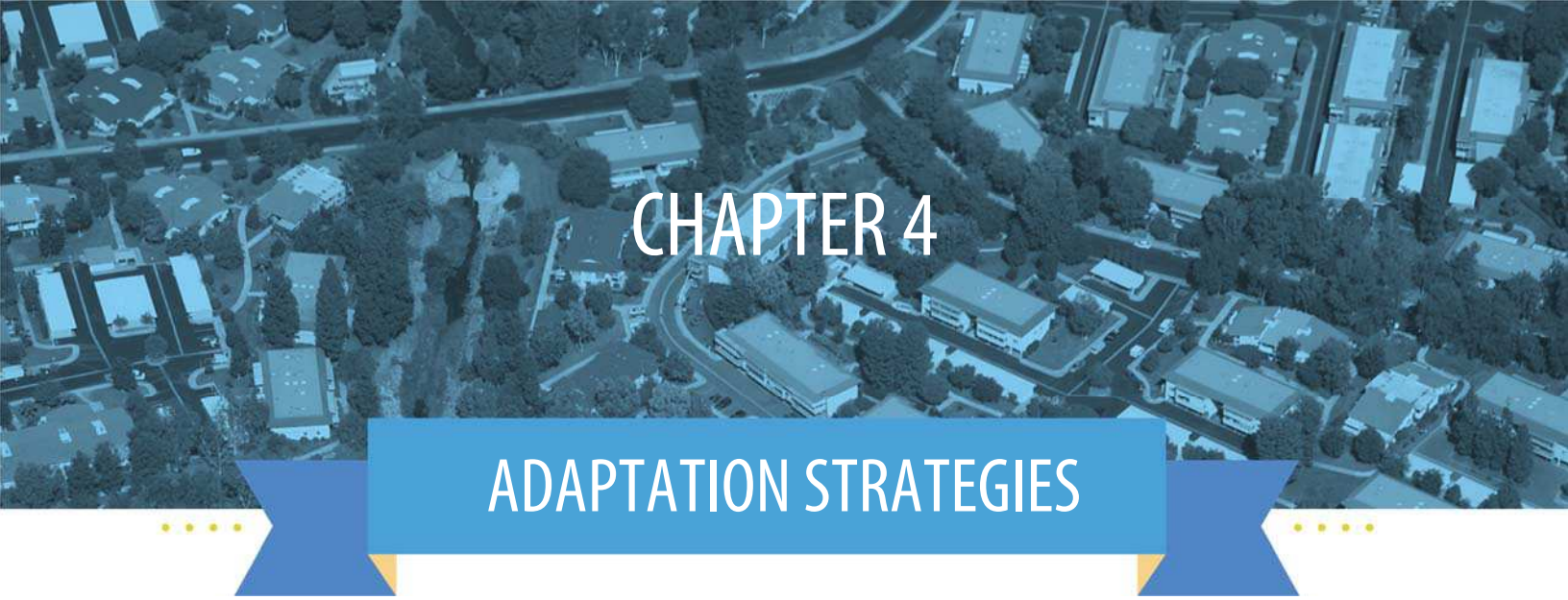
- El Toro Water District – The El Toro Water District has been active in decreasing Laguna Woods' demand for imported water by enforcing a water conservation ordinance, expanding its recycled water system, and participating in efforts to establish an ocean desalination plant in Huntington Beach. Public outreach and a tiered rate water structure have also contributed to reducing local water consumption.

- Southern California Edison – Southern California Edison has stated that it is committed to increasing electric generation and transmission capabilities and reliability, while also assisting residents with energy efficiency and conservation. Efforts include a financial assistance program for low-income customers, which helps to make those customers less vulnerable to the detrimental impacts of energy cost fluctuations.

- The residential communities located within Laguna Woods provide varying degrees of social resources for residents (e.g., networking clubs) and offer a variety of public safety and environmental programs (e.g., the Laguna Woods Village Disaster Preparedness Task Force and mutual board energy committees) that help to increase individual capacities to adapt to climate change. Efforts outside of the private gated community of Laguna Woods Village are considerably less developed and present an opportunity for enhancement.

Uncertainty still exists for local climate change exposures and impacts.

Annual precipitation, wind, and wildfires are climate change exposures for Laguna Woods; however, long-range regional projections do not currently exist, contradict across models, or have substantial uncertainty attached to them. It is important that the City continue to prepare for the potentially detrimental impacts associated with those exposures and that it update this Plan as additional data becomes available.



CHAPTER 4

ADAPTATION STRATEGIES

The City will pursue "no-regret" strategies that produce public value—including positive health and safety outcomes—regardless of how (or if) the climate changes over time. Those strategies will also lay the framework for more aggressive strategies as scientific understanding increases over time. The City will focus on reducing vulnerability to extreme heat and other climate change exposures with a public safety nexus and on reducing Laguna Woods' dependence on imported water and electricity.

Adaptation Strategies

Goals and Policy Objectives

The planning process described in this Plan resulted in the formulation of three goals and eight policy objectives (**Table 6**). Goals are general guidelines that explain the desired outcomes of this Plan, while policy objectives are more descriptive statements that define the strategies necessary to achieve goals.

Table 6: Climate Adaptation Goals and Policy Objectives

Summary	
GOAL 1	**Increase resilience to climate change-related hazards.**
Policy Objective 1.1	Maintain low levels of heat-related illness and death.
Policy Objective 1.2	Reduce wildfire impacts.
GOAL 2	**Increase resource independence.**
Policy Objective 2.1	Maintain electricity reliability and affordability through energy conservation, efficiency, and independence.
Policy Objective 2.2	Maintain potable water reliability and affordability through water conservation, efficiency, and independence.
Policy Objective 2.3	Demonstrate sustainable resource leadership.
GOAL 3	**Sustain and advance climate adaptation efforts.**

Policy Objective 3.1	Institutionalize climate adaptation as a citywide priority.
Policy Objective 3.2	Develop regional, state, national, and private climate adaptation partnerships.
Policy Objective 3.3	Continually monitor and update this Climate Adaptation Plan.

Implementation Actions

The planning process described in this Plan resulted in the 17 implementation actions described in this chapter. Implementation actions are activities, measures, and projects that help to achieve this Plan's goals and policy objectives. Where applicable, implementation actions have specific metrics and methods for assessing progress. Each of the implementation actions consider the following:

- **ISSUE:** What vulnerabilities or climate change–related issue does the action address?
- **BENEFIT:** What are the positive outcomes of the action?
- **COST:** Are the costs one-time or ongoing? What are the costs of establishing and maintaining the action?
    - Low (less than $25,000 in estimated staff and capital costs)
    - Medium-low (between $25,000 and $49,999 in estimated staff and capital costs)
    - Medium-high (between $50,000 and $99,999 in estimated staff and capital costs)
    - High (more than $100,000 in estimated staff and capital costs)
- **COORDINATION:** What levels of coordination are required to complete the action?
    - Low (little coordination required; action can largely be completed by the City)
    - Medium (some coordination required; action can largely be completed by the City)
    - High (substantial coordination required; the City is heavily reliant on others to complete action)
- **DELIVERABLE:** How will the action be implemented?
- **SUCCESS:** How will the action produce public value?

The City will pursue implementation actions as time and funding permits with the goal of demonstrating progress toward achieving each of the implementation actions within five years. The City Council retains the ability to modify or pursue implementation actions in the future at its sole and absolute discretion.

For the purpose of this chapter, references to "staff" are inclusive of staff and independent contractors.

GOAL 1: Increase resilience to climate change–related hazards.

Policy Objective 1.1: Maintain low levels of heat-related illness and death.

Implementation Action 1.1.1: Amend the Emergency Operations Plan to include an Extreme Heat Annex. The Emergency Operations Plan is the framework for the City's response to extraordinary emergency situations. Functional annexes (or, "chapters") are included in the Emergency Operations Plan to describe response efforts with respect to individual hazards (e.g., specific activities related to earthquakes, fires, floods).

The Extreme Heat Annex will be coordinated with the Orange County Operational Area's (OA) Extreme Heat Annex, identify potential cooling centers in Laguna Woods, promote access to regional cooling centers, and consider the needs of individuals with disabilities and access and functional needs.

- ISSUE: Extreme heat is Laguna Woods' most likely and impactful near-term climate change exposure.
- BENEFIT: Enhanced governmental response to extreme heat events.
- COST: *One-time*: Low (staff time to develop annex and seek City Council approval). *Ongoing*: Low (staff time to compile information for futures updates between comprehensive updates, as necessary).
- COORDINATION: Medium (coordination with public safety stakeholders).
- DELIVERABLE: An Extreme Heat Annex for inclusion in the Emergency Operations Plan.
- SUCCESS: Use of the annex to guide response efforts during extreme heat events.

Implementation Action 1.1.2: Adopt development standards to mitigate urban heat island effects. The urban heat island effect is a phenomenon in which temperatures in the local climate increase due to certain aspects of the built environment that retain or emit heat to a greater extent than would ordinarily exist in lesser developed areas (e.g., large areas of asphalt and impervious surfaces). The City will consider adopting development standards intended to reduce the solar reflectance and thermal properties of new and significant redevelopment projects. The City will specifically consider the adoption of standards requiring greater use of cool roofs, pervious surfaces, high albedo pavement, and shade over asphalt areas.

- ISSUE: Average temperatures may increase over time, and extreme heat is Laguna Woods' most likely and impactful near-term climate change exposure.
- BENEFIT: Reduction of factors contributing to temperature increases in the local climate.
- COST: *One-time*: Low (staff time to prepare development standards and seek City Council adoption). *Ongoing*: Low (staff time to ensure compliance with standards as a part of the development review process).
- COORDINATION: Low (review of development standards and best practices from outside organizations).
- DELIVERABLE: Development standards to mitigate urban heat island effects.
- SUCCESS: Enforcement of development standards to mitigate urban heat island effects.

Policy Objective 1.2: Reduce wildfire impacts.

Implementation Action 1.2.1: Amend the Emergency Operations Plan to include a Wildfire Air Quality Annex. The Emergency Operations Plan is the framework for the City's response to extraordinary emergency situations. Functional annexes (or, "chapters") are included in the Emergency Operations Plan to describe response efforts with respect to individual hazards (e.g., specific activities related to earthquakes, fires, floods). The City will develop a Wildfire Air Quality Annex to address emergency communication, public information, protective measures, and other matters related to degraded air quality caused by local or regional wildfires.

- ISSUE: Degraded air quality is an impactful secondary effect of wildfires, which may become an increasing local threat as a result of climate change.
- BENEFIT: Enhanced governmental response to degraded air quality events.
- COST: *One-time*: Low (staff time to develop annex and seek City Council approval). *Ongoing*: Low (staff time to compile information for future updates between comprehensive updates, if necessary).
- COORDINATION: Medium (coordination with public safety stakeholders).
- DELIVERABLE: A Wildfire Air Quality Annex for inclusion in the Emergency Operations Plan.
- SUCCESS: Use of the annex to guide response efforts during degraded air quality events caused by local or regional wildfires.

Implementation Action 1.2.2: Review and amend landscape and property maintenance standards to continue to mitigate the potential for wildfire propagation into developed areas. The City will review and amend its landscape and property maintenance standards to further promote best practices related to fire safety and defensible space. The City will specifically consider the adoption of standards requiring the installation of fire-resistant plantings, the placement and maintenance of plantings in a manner that provides increased clearance around structures, and the removal of accumulated plant materials, debris, and other potential wildfire fuels. The City will also consider standards related to mitigating the secondary impacts of wildfires, including erosion and landslides caused by the destruction of slope and hillside vegetation.

- ISSUE: Wildfire risk may be exacerbated in Laguna Woods due to both climate change and Santa Ana Wind conditions, which have the potential to transport wildfire embers into developed areas.
- BENEFIT: Reduction of factors contributing to the escalation of wildfire risk.
- COST: *One-time*: Low (staff time to prepare development standards and seek City Council adoption). *On-going*: Low (staff time to ensure compliance with standards as a part of the development review process).
- COORDINATION: Low (review of development standards and best practices from outside organizations).
- DELIVERABLE: Standards to mitigate the potential for wildfire propagation into developed areas.
- SUCCESS: Enforcement of development standards to reduce wildfire risk.

GOAL 2: Increase resource independence.

Policy Objective 2.1: Maintain electricity reliability and affordability through energy conservation, efficiency, and independence.

Implementation Action 2.1.1: Develop a protocol for monitoring electricity use. The City will develop a protocol using information from Southern California Edison's annual community electricity reports that will allow it to monitor and more quantifiably address electricity issues. The protocol will establish a local electric

use and generation baseline and be updated every three years to include emergent conditions. In addition, the protocol will be used to assess the success of implementation actions 2.1.2 and 2.1.3.

- ISSUE: Strained energy systems are an impactful secondary effect of increased average temperatures and extreme heat, both of which may become increasing local threats as a result of climate change.
- BENEFIT: Enhanced information with respect to local electricity-related issues.
- COST: *One-time*: Low-medium (staff time to develop protocol, coordinate with Southern California Edison, and generate findings). *Ongoing*: Low (staff time to update every three years).
- COORDINATION: Medium (coordination with Southern California Edison).
- DELIVERABLE: A protocol for monitoring electricity-related issues.
- SUCCESS: Use of the protocol to assess the success of this Plan and inform future updates of this Plan.

Implementation Action 2.1.2: Streamline development and permitting standards and programs to encourage renewable energy technologies and energy efficiency improvements. The City will review and amend its development and permitting standards, as necessary, to alleviate regulatory impediments affecting the use or installation of renewable energy technologies and energy efficiency improvements (e.g., photovoltaic systems, weatherization). The City will also consider developing and implementing incentive programs (e.g., fee reductions/waivers, expedited processing).

- ISSUE: Strained energy systems are an impactful secondary effect of increased average temperatures and extreme heat, both of which may become increasing local threats as a result of climate change.
- BENEFIT: Improved energy reliability, affordability, and independence.
- COST: *One-time*: Medium-high (staff time to review/prepare standards, develop/implement programs, and seek City Council adoption; unknown costs associated with resultant deliverables). *Ongoing*: Low (staff time to ensure compliance with standards as a part of the development review process and implement/maintain programs; unknown costs associated with deliverables).
- COORDINATION: Low (review of development standards and best practices from outside organizations; public outreach to quantify perceived regulatory impediments, needs, and desires).
- DELIVERABLE: Streamlined development and permitting standards and programs to encourage renewable energy technologies and energy efficiency improvements.
- SUCCESS: In conjunction with other implementation actions in this Plan and other steps taken by the City, local community, and Southern California Edison, Laguna Woods' grid electricity use decreases 10% below baseline levels and one additional megawatt of renewable energy is installed by 2020 (measured using the protocol established in Implementation Action 2.1.1).

Implementation Action 2.1.3: Join one or more Property Assessed Clean Energy (PACE) programs. The City will join one or more PACE programs, as enabled by state law, in order to provide increased options for

residents and businesses to finance renewable energy technologies and energy efficiency improvements. See also Implementation Action 2.2.2 for associated water benefits.

- ISSUE: Strained energy systems are an impactful secondary effect of increased average temperatures and extreme heat, both of which may become increasing local threats as a result of climate change.
- BENEFIT: Improved energy reliability, affordability, and independence.
- COST: *One-time*: Low (staff time to identify programs to join, prepare necessary documentation, and seek City Council approval). *Ongoing*: Low (promotional only; programs are independently administered).
- COORDINATION: Low (coordination with program administrators).
- DELIVERABLE: Participation in one or more Property Assessed Clean Energy (PACE) programs.
- SUCCESS: In conjunction with other implementation actions in this Plan and other steps taken by the City, local community, and Southern California Edison, Laguna Woods' grid electricity use decreases 10% below baseline levels and one additional megawatt of renewable energy is installed by 2020 (measured using the protocol established in Implementation Action 2.1.1).

Policy Objective 2.2: Maintain potable water reliability and affordability through water conservation, efficiency, and independence.

Implementation Action 2.2.1: Review and amend development and permitting standards to reduce potable water consumption. The City will review and amend its development and permitting standards, as necessary, to reduce the amount of potable water consumed across all land use patterns. An emphasis will be placed on standards that empower individuals to regulate personal water consumption (e.g., expanded individual water metering) and increase on-site stormwater capture, storage, and reuse (e.g., rain barrels). The City will specifically consider the adoption of water-efficient landscape and Low Impact Development (LID) standards, as well as standards included in the Local Government Commission's Ahwahnee Water Priniciples.

- ISSUE: Strained water availability compounded by reductions in annual precipitation are two of Laguna Woods' potentially impactful climate change exposures.
- BENEFIT: Improved water reliability, affordability, and independence.
- COST: *One-time*: Medium-low (staff time to review/prepare standards and seek City Council adoption). *Ongoing*: Low (staff time to ensure compliance with standards as part of the development review process).
- COORDINATION: Low (review of development standards and best practices from outside organizations; coordination with the El Toro Water District).
- DELIVERABLE: Development and permitting standards to reduce potable water consumption.
- SUCCESS: In conjunction with other implementation actions in this Plan and other steps taken by the City, local community, and El Toro Water District, per-capita potable water use in Laguna Woods decreases 20% below baseline levels by 2020 (calculated pursuant to Senate Bill X7-7).

Implementation Action 2.2.2: Join one or more Property Assessed Clean Energy (PACE) programs. The City will join one or more PACE programs, as enabled by state law, in order to provide increased options for residents and businesses to finance water efficiency improvements. See also Implementation Action 2.1.3 for associated energy benefits.

- ISSUE: Strained water availability compounded by reductions in annual precipitation are two of Laguna Woods' potentially impactful climate change exposures.
- BENEFIT: Improved water reliability, affordability, and independence.
- COST: *One-time*: Low (staff time to identify programs to join, prepare necessary documentation, and seek City Council approval). *Ongoing*: Low (promotional only; programs are independently administered).
- COORDINATION: Low (coordination with program administrators).
- DELIVERABLE: Participation in one or more Property Assessed Clean Energy (PACE) programs.
- SUCCESS: In conjunction with other implementation actions in this Plan and other steps taken by the City, local community, and El Toro Water District, per-capita potable water use in Laguna Woods decreases 20% below baseline levels by 2020 (calculated pursuant to Senate Bill X7-7).

Policy Objective 2.3: Demonstrate sustainable resource leadership.

Implementation Action 2.3.1: Manage the City's urban forest and landscaping in a changing climate. The City will develop and implement an Urban Forestry Management and Landscape Master Plan to adapt the living elements of public property (e.g., street trees, parks, parkways, and medians) to potential climate change impacts. The Master Plan will include a street tree inventory and maintenance guide, water-efficient and fire-resistant plant palettes, methodology for reducing energy and water consumption, and an approach to mitigating urban heat island effects. The Master Plan will specifically consider opportunities to remove turf, retrofit irrigation systems, increase shade over asphalt areas, and enhance preventive maintenance.

- ISSUE: The City's urban forest and landscaping is threatened by numerous potentially impactful climate change exposures, including increased average temperatures, extreme heat, wildfires, and strained water availability compounded by decreased annual precipitation.
- BENEFIT: Reduction of factors contributing to temperature increases in the local climate; improved energy and water reliability, affordability, and independence; and long-term sustainability of City property.
- COST: *One-time*: Medium-high (staff time to develop plan and seek City Council approval). *Ongoing*: Low (staff time to implement/maintain plan; unknown costs associated with resultant deliverables).
- COORDINATION: Low (review of plans, standards, and best practices from outside organizations).
- DELIVERABLE: An Urban Forestry Management and Landscape Master Plan.
- SUCCESS: Reduction of City property contributions to urban heat island effects; and

In conjunction with other implementation actions in this Plan and other steps taken by the City, local community, and Southern California Edison, Laguna Woods' grid electricity use decreases 10% below baseline levels and one additional megawatt of renewable energy is installed by 2020 (measured using the protocol established in Implementation Action 2.1.1); and

In conjunction with other implementation actions in this Plan and other steps taken by the City, local community, and El Toro Water District, per-capita potable water use in Laguna Woods decreases 20% below baseline levels by 2020 (calculated pursuant to Senate Bill X7-7).

Implementation Action 2.3.2: Develop and implement municipal renewable energy technology and energy efficiency improvement projects. The City will consider developing and implementing projects to expand the use of renewable energy technologies and enhance the energy efficiency of City structures and operations (e.g., photovoltaic systems, weatherization, anaerobic digestion opportunities for organic matter, energy management systems, and light-emitting diode [LED] conversion of streetlight fixtures). Metrics will be made available to the public quantifying positive outcomes to the extent practicable.

- ISSUE: Strained energy systems are an impactful secondary effect of increased average temperatures and extreme heat, both of which may become increasing local threats as a result of climate change. The City's ability to provide critical emergency and non-emergency services is also threatened.
- BENEFIT: Improved energy reliability, affordability, and independence; heightened awareness of energy-related matters; and long-term sustainability of public property.
- COST: *Ongoing*: High (staff time to develop/implement projects and seek City Council approval; unknown costs associated with deliverables).
- COORDINATION: Low-medium (review of projects and best practices from outside organizations; regional or larger-scale projects would likely involve multiple stakeholders and require increased coordination).
- DELIVERABLE: Municipal renewable energy technology and energy-efficiency projects.
- SUCCESS: Electricity use by City properties falls 10% by 2020, compared to 2010 levels; and

  In conjunction with other implementation actions in this Plan and other steps taken by the City, local community, and Southern California Edison, Laguna Woods' grid electricity use decreases 10% below baseline levels and one additional megawatt of renewable energy is installed by 2020 (measured using the protocol established in Implementation Action 2.1.1).

Implementation Action 2.3.3: Provide and facilitate public education opportunities regarding energy and water conservation, efficiency, and independence. The City will collaborate with Southern California Edison, the El Toro Water District, and other stakeholders to ensure that a broad array of opportunities for energy- and water-related education are made available to residents and businesses. The City will specifically advocate for the use of diverse media that is responsive to local demographics (e.g., print, audio/visual, and online materials available in multiple languages and optimized for older adults and individuals with access and functional needs), as well as messaging that empowers individuals to make positive change, while also

underscoring the interrelation of environmental, public safety, and economic (cost-benefit) impacts. Energy- and water-related audit programs will also be emphasized to drive informed decision-making.

- ISSUE: Strained energy systems are an impactful secondary effect of increased average temperatures and extreme heat, both of which may become increasing local threats as a result of climate change. Strained water availability compounded by reductions in annual precipitation are two of Laguna Woods' potentially impactful climate change exposures.
- BENEFIT: Improved energy and water reliability, affordability, and independence; heightened awareness of energy- and water-related matters.
- COST: *Ongoing*: Low (staff time to provide/facilitate public education opportunities).
- COORDINATION: High (coordination with Southern California Edison, El Toro Water District, and others).
- DELIVERABLE: A broad array of energy- and water-related public education opportunities that are widely accessible by all segments of Laguna Woods' populations.
- SUCCESS: Incrementally higher numbers of individuals exposed to public education; and

  In conjunction with other implementation actions in this Plan and other steps taken by the City, local community, and Southern California Edison, Laguna Woods' grid electricity use decreases 10% below baseline levels and one megawatt of additional renewable energy is installed by 2020 (measured using the protocol established in Implementation Action 2.1.1); and

  In conjunction with other implementation actions in this Plan and other steps taken by the City, local community, and El Toro Water District, per-capita potable water use in Laguna Woods decreases 20% below baseline levels by 2020 (calculated pursuant to Senate Bill X7-7).

GOAL 3: Sustain and advance climate adaptation efforts.

Policy Objective 3.1: Institutionalize climate adaptation as a citywide priority.

Implementation Action 3.1.1: Incorporate climate adaptation into long-range planning documents. As a part of routine updates, the City will increasingly address climate change exposures, potential climate change impacts, local vulnerabilities, and other climate adaptation–related considerations in its relevant long-range planning documents (e.g., General Plan, Local Hazard Mitigation Plan).

- ISSUE: The City's planning documents generally do not consider climate adaptation.
- BENEFIT: Comprehensive long-range strategy to increase resilience to climate change.
- COST: *One-time*: Low (incorporation to occur with routine plan updates; staff time to incorporate). *Ongoing*: Low (staff time to compile information for future updates between routine updates, as necessary).
- COORDINATION: Medium (coordination with resources beyond those that would ordinarily be required to update plans if climate adaptation issues were not considered).

- DELIVERABLE: Long-range planning documents that consider best available climate information.
- SUCCESS: Increased awareness and consideration of climate adaptation.

Policy Objective 3.2: Develop regional, state, national, and private climate adaptation partnerships.

Implementation Action 3.2.1: Participate in climate adaptation forums and events. Climate adaptation is an emerging field in which the City is an early leader, having developed one of the state's first non-coastal climate adaptation plans and one of the first climate adaptation plans to use the methodology outlined in the California Adaptation Planning Guide. Representatives of the City will attend climate adaptation forums and events, whenever possible, and consider submitting session proposals to share local efforts.

- ISSUE: Climate change is a global problem that necessitates collaborative and integrated adaptation efforts far beyond those that the City is able to independently effectuate.
- BENEFIT: Heightened awareness of the City's climate adaptation efforts; development of partnerships with outside organizations and stakeholders in pursuit of similar goals; and increased knowledge of emerging information, data sets, and tools to help guide future climate adaptation efforts.
- COST: *Ongoing*: Low (staff time to participate in forums and events; possible registration fees and travel).
- COORDINATION: Low (participation is at the City's discretion).
- DELIVERABLE: Participation in climate adaptation forums and events.
- SUCCESS: Enhanced internal capacity to sustain and advance climate adaptation efforts.

Implementation Action 3.2.2: Support legislation that would assist communities with efforts to adapt to a changing climate. The City will consider supporting state and federal legislation that, if chaptered into law, would measurably benefit climate adaptation at the local level. The City will specifically consider supporting legislation related to energy and water reliability, affordability, and independence; climate-related emergency planning; and funding for the development and implementation of climate adaptation plans.

- ISSUE: Local communities exist in an environment that is subject to state and federal laws, which could be enhanced in order to better assist with efforts to adapt to a changing climate.
- BENEFIT: Increased governmental support and resources to pursue climate adaptation efforts.
- COST: *Ongoing*: Low (staff time to identify legislation, interact with legislative offices, and coordinate with other stakeholders; staff time to monitor legislation and respond to changes in status).
- COORDINATION: Medium (coordination with the League of California Cities and other stakeholders).
- DELIVERABLE: Dialogue with legislative offices on matters related to pending or potential legislation.
- SUCCESS: Legislation chaptered into law to assist communities with efforts to adapt to a changing climate; heightened awareness of climate adaptation issues at the state and federal levels.

Policy Objective 3.3: Continually monitor and update this Climate Adaptation Plan.

Implementation Action 3.3.1: Conduct annual monitoring of this Climate Adaptation Plan. City staff will prepare and submit an annual monitoring report to the City Council. The annual monitoring report will highlight the status of this Plan's implementation action items, summarize activities and conditions affecting this Plan, and evaluate the overall effectiveness of this Plan as currently implemented.

- ISSUE: Climate adaptation is an emerging field both locally and at higher levels of government that involves a multitude of changing variables and long-term goals, policy objectives, and implementation actions.
- BENEFIT: Transparency and accountability with respect to the City's climate adaptation efforts, as well as the promotion of informed decision-making and an iterative process of continual improvement.
- COST: *Ongoing*: Low (staff time to prepare reports).
- COORDINATION: Low (internal coordination to compile information).
- DELIVERABLE: Annual monitoring reports.
- SUCCESS: Use of annual monitoring reports to help guide and improve climate adaptation efforts.

Implementation Action 3.3.2: Update this Climate Adaptation Plan concurrent with the City's Local Hazard Mitigation Plan. The City recognizes that climate adaptation planning has significant commonality with local hazard mitigation planning efforts, including a focus on resilience to natural hazards. Accordingly, the City will update this Plan every five years, concurrent with statutorily required updates of its Local Hazard Mitigation Plan. In order to align the cycles of both plans, the first update to this Plan will occur with the next update of the Local Hazard Mitigation Plan in late 2017. In the interest of transparency and accountability, City Council adoption of any updates to this Plan will occur following duly noticed public hearings.

- ISSUE: Climate adaptation is an emerging field both locally and at higher levels of government that involves a multitude of changing variables and long-term goals, policy objectives, and implementation actions.
- BENEFIT: Continual improvements to the City's long-term approach to a changing climate; integration with other long-term planning documents resulting in increased efficiency, effectiveness, and economy.
- COST: *One-time*: Medium-low (staff time to prepare update and seek City Council approval).
- COORDINATION: High (coordination with numerous stakeholders).
- DELIVERABLE: An updated Climate Adaptation Plan for a period spanning 2018–2023.
- SUCCESS: Iterative improvement in this Plan's content and approach to climate adaptation.

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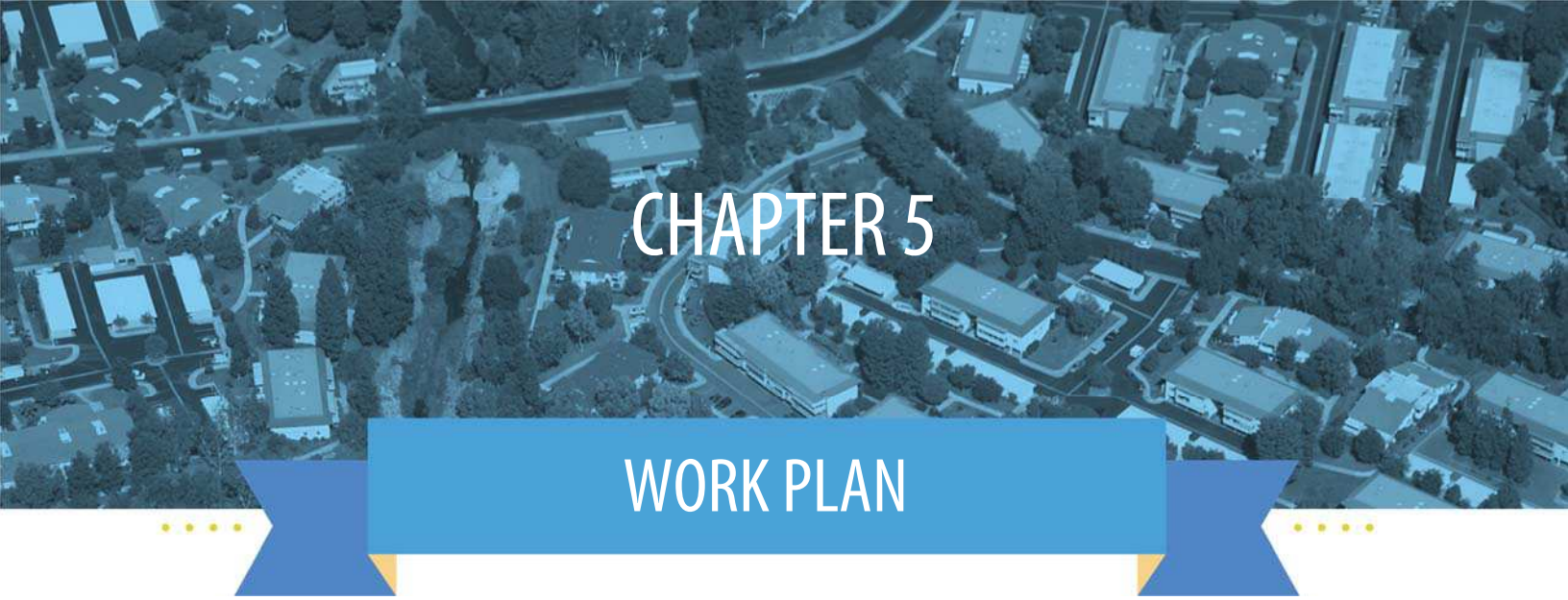

CHAPTER 5

WORK PLAN

In order for this Climate Adaptation Plan to be successful, it must be implemented in a manner that is responsive to local needs and circumstance. Cost effectiveness, impacts on financial and operational resources, and the presence of any co-benefits (including synergy with other long-term City planning documents) are important considerations prior to undertaking implementation actions.

Introduction

A work plan (**Table 8**) has been prepared to support the implementation of this Plan, as well as to assist with the reporting of this Plan's status and effectiveness. The work plan includes the following information for each of the 17 implementation actions described in greater detail in **Chapter 4**:

- **COSTS AND COORDINATION:** As discussed in **Chapter 4**
- **POTENTIAL FUNDING SOURCES:** Indicates whether third-party funding may potentially be available
- **OTHER LOCAL ACTIONS IMPLEMENTED:** Identifies whether an implementation action would also help to accomplish items in the General Plan Safety Element and/or the Local Hazard Mitigation Plan

The following tables are provided with information corresponding to references in the work plan:

- **TABLE 7:** A key for the iconography used to visually depict cost and coordination levels
- **TABLE 9:** A list of the projects included in the Local Hazard Mitigation Plan
- **TABLE 10:** A list of the goals included in the General Plan Safety Element

The work plan will be used as the basis for this Plan's annual monitoring reports (**Implementation Action 3.3.1**).

Work Plan

Table 7: Work Plan Key

Cost				Coordination		
$	$$	$$$	$$$$			
Low (less than $25,000)	Medium-low ($25,000–$49,999)	Medium-high ($50,000–$99,999)	High ($100,000 or more)	Low	Medium	High

Table 8: Work Plan

Implementation Action	Costs and Coordination		Potential Funding Sources	Other Local Actions Implemented	Status/Effectiveness
1.1.1: Amend the Emergency Operations Plan to include an Extreme Heat Annex.	One-time costs	$	General Fund; grants for disaster preparedness, climate adaptation, public health, etc.	**LHMP**: Projects M, U, W, Y and Z **Safety Element:** Goals S-4 and S-5	
	Ongoing costs	$			
	Coordination				
1.1.2: Adopt development standards to mitigate urban heat island effects.	One-time costs	$	General Fund	**LHMP**: Projects A, B, and M **Safety Element:** Goals S-4 and S-5	
	Ongoing costs	$			

Implementation Action	Costs and Coordination		Potential Funding Sources	Other Local Actions Implemented	Status/Effectiveness
	Coordination				
1.2.1: Amend the Emergency Operations Plan to include a Wildfire Air Quality Annex.	One-time costs		General Fund; grants for disaster preparedness, climate adaptation, public health, etc.	**LHMP**: Projects M, U, W, Y, and Z **Safety Element:** Goals S-1 and S-5	
	Ongoing costs				
	Coordination				
1.2.2: Review and amend landscape and property maintenance standards to continue to mitigate the potential for wildfire propagation into developed areas.	One-time costs		General Fund; grants for disaster preparedness, climate adaptation, public health, etc.	**LHMP**: Projects A, B, and H **Safety Element:** Goal S-1	
	Ongoing costs				
	Coordination				
2.1.1: Develop a protocol for monitoring electricity use.	One-time costs		General Fund	**LHMP**: Projects D and M **Safety Element:** Goals S-4 and S-5	
	Ongoing costs				
	Coordination				

Implementation Action	Costs and Coordination		Potential Funding Sources	Other Local Actions Implemented	Status/Effectiveness
2.1.2: Streamline development and permitting standards and programs to encourage renewable energy technologies and energy efficiency improvements.	One-time costs	$$$	General Fund; grants for energy independence and renewable energy, sustainability, climate adaptation, etc.	**LHMP**: Projects A, B, and D **Safety Element:** Goal S-4	
	Ongoing costs	$			
	Coordination				
2.1.3: Join one or more Property Assessed Clean Energy (PACE) programs.	One-time costs	$	General Fund	**LHMP**: Projects D and R **Safety Element:** Goal S-4	
	Ongoing costs	$			
	Coordination				
2.2.1: Review and amend development and permitting standards to reduce potable water consumption.	One-time costs	$$	General Fund; grants for water conservation, sustainability, climate adaptation, etc.	**LHMP**: Projects A, B, and E **Safety Element**: Goal S-4	
	Ongoing costs	$			
	Coordination				

Implementation Action	Costs and Coordination		Potential Funding Sources	Other Local Actions Implemented	Status/Effectiveness
2.2.2: Join one or more Property Assessed Clean Energy (PACE) programs.	One-time costs	$	General Fund	**LHMP**: Projects D and S **Safety Element:** Goal S-4	
	Ongoing costs	$			
	Coordination	1			
2.3.1: Manage the City's urban forest and landscaping in a changing climate.	One-time costs	$$$	General Fund; grants for energy independence and renewable energy, sustainability, climate adaptation, etc.	**LHMP**: Projects M, R, and S **Safety Element:** Goals S-4 and S-5	
	Ongoing costs	$			
	Coordination	1			
2.3.2: Develop and implement municipal renewable energy technology and energy efficiency improvement projects.	One-time costs	—	General Fund; grants for energy independence and renewable energy, sustainability, climate adaptation, etc.	**LHMP**: Projects M and R **Safety Element:** Goals S-4 and S-5	
	Ongoing costs	$$$$			
	Coordination	2			
2.3.3: Provide and facilitate public education opportunities regarding energy and water conservation, efficiency, and independence.	One-time costs	—	General Fund; grants for energy independence and renewable energy, water conservation, community engagement and outreach, sustainability, climate adaptation, etc.	**LHMP**: Project M **Safety Element:** Goal S-5	
	Ongoing costs	$			

Implementation Action	Costs and Coordination		Potential Funding Sources	Other Local Actions Implemented	Status/Effectiveness
	Coordination				
3.1.1: Incorporate climate adaptation into long-range planning documents.	One-time costs		General Fund; grants for energy independence and renewable energy, water conservation, community engagement and outreach, sustainability, climate adaptation, etc.	**Safety Element:** Goal S-5	
	Ongoing costs				
	Coordination				
3.2.1: Participate in climate adaptation forums and events.	One-time costs		General Fund; forum and event sponsorships; grants for climate adaptation, etc.	**Safety Element**: Goals S-4 and S-5	
	Ongoing costs				
	Coordination				
3.2.2: Support legislation that would assist communities with efforts to adapt to a changing climate.	One-time costs		General Fund	**Safety Element**: Goal S-5	
	Ongoing costs				
	Coordination				

Implementation Action	Costs and Coordination		Potential Funding Sources	Other Local Actions Implemented	Status/Effectiveness
3.3.1: Conduct annual monitoring of this Climate Adaptation Plan.	One-time costs	—	General Fund; grants for sustainability, climate adaptation, etc.	**Safety Element**: Goal S-5	
	Ongoing costs	$			
	Coordination	🧍			
3.3.2: Update this Climate Adaptation Plan concurrent with the City's Local Hazard Mitigation Plan.	One-time costs	$$	General Fund; grants for sustainability, climate adaptation, etc.	**Safety Element**: Goal S-5	
	Ongoing costs	—			
	Coordination	🧍🧍🧍			

Table 9: Local Hazard Mitigation Plan Action Items

Project	Description
A	Review and update building-related ordinances and policies, as necessary.
B	Review and update zoning-related ordinances and policies, as necessary.
C	Adopt an ordinance requiring emergency backup generators for new and redeveloped fuel stations and cellular telephone towers.
D	Develop and implement plans, projects, and programs that reduce energy use and meet critical energy supply needs during emergencies.
E	Develop and implement plans, projects, and programs that reduce water use and augment local water supplies (e.g., capture/reuse).
F	Adopt an ordinance prohibiting invasive plant species from existing within the city.
G	Develop and implement localized flood reduction projects (e.g., culverts and detention basins).
H	Maintain defensible space for wildfires throughout the wildland-urban interface area.
I	Comply with National Flood Insurance Program (NFIP) regulations.
J	Participate in and implement findings of NFIP Community Assistance Visits, triennially.
K	Perform local floodplain assessments to improve the accuracy of maps used in the NFIP.
L	Enhance the local specificity and estimative accuracy of Hazus analyses.
M	Develop and implement volunteer and community education programs and projects with a focus on risk awareness and hazard mitigation.
N	Retrofit City Hall in accordance with federal hazard-resistance guidance [e.g., FEMA 310 (ASCE 31), FEMA 356 (superseded by ASCE 41)].
O	Install an emergency backup generator for City Hall and the Emergency Operations Center.
P	Design and construct a permanent Emergency Operations Center for the City.
Q	Improve emergency backup capabilities for City traffic control and management devices.
R	Develop and implement plans, projects, and programs that reduce energy use by City facilities and meet critical energy supply needs during emergencies.
S	Develop and implement plans, projects, and programs that reduce water use at City facilities and augment local water supplies (e.g., capture/reuse).
T	Operate a mass notification system for rapid communication during emergencies.
U	Increase emergency communications capabilities between internal and external coordination points (e.g., shelters, key service providers).

Project	Description
V	Develop and implement a Continuity of Operations Plan for City services (COOP).
W	Train staff in emergency services functions [e.g., the National Incident Management System (NIMS), Standardized Emergency Management System (SEMS), Incident Command System (ICS), and Cal EMA Safety Assessment Program (SAP)].
X	Develop and implement systems to access and manage critical information during emergencies.
Y	Develop memoranda of understanding (MOUs) for emergency reception centers, shelters, and points of dispensing (PODs).
Z	Develop MOUs for emergency provisions (e.g., food, water, and generator fuel).
AA	Conduct annual monitoring and maintenance of the Local Hazard Mitigation Plan.
BB	Update the Local Hazard Mitigation Plan at least once every five years, including integration into the City's General and Capital Improvement Plans.

Table 10: General Plan Safety Element Goals

Goal	Description
Goal S-1	Protect residents, businesses, and government functions from fire hazards.
Goal S-2	Protect residents, businesses, and government functions from flood hazards.
Goal S-3	Protect residents, businesses, and government functions from geologic and seismic hazards.
Goal S-4	Protect residents, businesses, and government functions from human-caused and other hazards.
Goal S-5	Ensure that residents, businesses, and government functions are ready for emergencies.
Goal S-6	Improve community safety and reduce opportunities for criminal activity.

Glossary

Adaptation – Adjustments in natural or human systems in response to actual or expected climate changes or their effects which minimize harm or take advantage of beneficial opportunities (CNRA 2009).

Adaptive Capacity – The ability of a system to respond to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities, and to cope with the consequences (CNRA 2009).

Albedo – The fraction of sunlight that is reflected when sunlight hits an opaque surface (Akbari 2005).

Climate Change – Any long-term change in average climate conditions in a place or region, whether due to natural causes or as a result of human activity (CNRA 2009).

Climate Variability – Variations in the mean state of the climate and other statistics (such as standard deviations or the occurrence of extremes) on all temporal and spatial scales beyond that of individual weather events (CNRA 2009).

Conservation – The preservation of natural resources in their natural, scenic, agricultural, historical, forested, or open space condition (California Civil Code).

Cooling Center – A designated public facility, often air-conditioned, where people may go for relief during periods of extreme heat (Oxford Dictionary n.d.).

Energy Conservation – Saving energy by reducing or going without an energy-using service, such as turning off a light when leaving the room or unplugging an appliance that is not in use (LBNL 2014).

Energy Efficiency – Saving energy by using less energy to provide the same or better service, such as replacing a washing machine with a model that washes clothes as effectively as the previous device but requires less energy (LBNL 2014).

Exposure – The climate changes that a community will likely experience based on available data (Cal OES and CNRA 2012).

HAZUS – A nationally applicable standardized methodology that contains models for estimating potential losses from earthquakes, floods and hurricanes. HAZUS uses Geographic Information Systems (GIS) technology to estimate physical, economic, and social impacts of disasters (Cal OES 2013).

Impact – An effect of climate change on the structure or function of a system (CNRA 2009).

Mitigation – In hazard mitigation planning, mitigation means "sustained action taken to reduce or eliminate the long-term risk to human life and property from natural, human-caused, and technological hazards and their effects. Note that this emphasis on long-term risk distinguishes mitigation from actions geared primarily to emergency preparedness and short-term recovery" (Cal OES 2013).

Renewable Energy – Energy sources that restore themselves over short periods of time and do not diminish. In California, this includes solar, wind, geothermal, biomass, and limited types of hydroelectric generation (CPRC, n.d.)

Resilience – The ability of a community, natural resource, or system to anticipate, absorb, accommodate, or recover from the effects of a potentially hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions (IPCC 2007).

Resource Conservation – Reducing the use of a resource (water, electricity, fuel, etc.) by reducing the use of services or devices that require the resource; in short, doing less with less (EPA 2014; LBNL 2014).

Resource Efficiency – Reducing the use of a resource (water, electricity, fuel, etc.) by using less of the resource to provide the same service; in short, doing the same or more with less (EPA 2014; LBNL 2014).

Risk – The possibility of interaction of physically defined hazards with the exposed systems. Risk is commonly considered to be the combination of the likelihood of an event and its consequences—i.e., risk equals the probability of climate change impact occurring multiplied by the consequences a given system may experience (CNRA 2009).

Sensitivity – A structure, function, or population that could be affected by climate change (Cal OES and CNRA 2012). The City's Local Hazard Mitigation Plan defines it similarly, but uses the terms "property," "service," and "people" in place of "structure," "function," or "population."

Sustainability – A process in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspiration; sustainability integrates the political, social, economic, and environmental (IPCC 2007). A more common and concise definition of sustainability is a system that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED 1987).

System – A human population or ecosystem; or a group of natural resources, species, infrastructure, or other assets (CNRA 2009).

Urban Heat Island – A phenomenon in which developed areas are warmer than rural zones due to the prevalence of impermeable, dry, and heat-absorbing surfaces (such as asphalt and concrete) in urban areas (Akbari 2005).

Vulnerability – A susceptibility to harm or change. More specifically, the degree to which a system is exposed to, susceptible to, and unable to cope with the adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, as well as of non-climatic characteristics of the system, including its adaptive capacity (CNRA 2009).

Water Conservation – Saving water by reducing the use of services that require water, such as replacing a lawn with plants that require little or no irrigation (EPA 2014).

Water Efficiency – Saving water by using less water to provide the same or better service, such as a faucet with a model that satisfies the same needs as the previous faucet but requires less water (EPA 2014).

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